AVIFAUNA INVENTORY OF ELK ISLAND NATIONAL PARK

INTERIM REPORT 1984/85

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1. INTRODUCTION

1.1 Physical Description of the Study Area

Elk Island National Park (EINP) includes 196 km^2 of hummocky terrain in the Beaver Hills of central Alberta, 30 km east of Edmonton. The area is characterized by knob and kettle topography with numerous water bodies ranging in size from less than 1 ha to 546 ha (Astotin Lake).

A detailed description of vegetation resources was prepared by Techman Ltd. (1979). The park is predominantly covered with aspen (Populus tremuloides) and balsam poplar (P. balsamifera) forests that have become established mostly during the last 60 years (C. Blyth pers. comm., based on air photo interpretation). While most of the vegetation is very similar to that of other areas in the Aspen Parkland ecoregion, the presence of stands of white spruce (Picea glauca) and of small fens dominated by black spruce (P. mariana), tamarack (Larix laricina) and labrador tea (Ledum groenlandicum) indicate that the area is transitional to Mixedwood Boreal Forest.

The surrounding area is extensively modified by agriculture, with exotic forage and grain crops dominating the cleared areas. Natural grassland is very scarce and confined to small areas both outside and within the park. Within the park the most extensive open areas are north of Highway 16 and east of the parkway, an area that was formerly cultivated and continues to support exotic forage species. Even the small patches of undisturbed grassland in the park have been modified by heavy grazing pressure from bison and elk so that they are now dominated by

Kentucky bluegrass (Poa pratensis), clover (Trifolium spp.) and dandelion (Taraxacum officinale).

Hollows and drainage channels with sedge (Carex spp.), willow (Salix spp.) and alder (Alnus sinuata) vegetation are widespread. A high beaver population has considerably modified the vegetation of these areas through construction and abandonment of dams and clearing of woody vegetation.

1.2 History of Resource Management and Inventory

Elk Island National Park was established in 1913 primarily for the preservation of elk and other ungulates in the Beaver Hills. Initially only the northern one-third of what is now EINP was included within the park boundaries, with further increments being added in 1947 and 1978 when the park attained its present size.

Protection of ungulates within a fenced area where large predators are absent, led to unnaturally high populations of bison, moose, elk and white-tailed deer. Protection of vegetation from fire following extensive burns in the early part of the century allowed a rapid expansion of deciduous forest cover in what had been a more open parkland-like area. The dynamics of these interactions among ungulates, vegetation and resource management are being investigated in depth by Chuck Blyth, EINP Warden Service.

The importance of managing national parks as ecosystems, with appropriate emphasis on all resource sectors including landforms, soils, vegetation, mammals, birds and other wildlife, became increasingly accepted during the 1960s and 1970s. This broader view of the responsi-

bilities of national park resource managers contributed to the 1982 Parks Canada Natural Resource Management Process Manual.

Before resource management plans can be finalized and implemented, each national park requires detailed inventories of its natural resources. In EINP the resource inventory process was begun in the mid-1970s. An inventory of wetland types and water-associated birds was completed first (Kemper 1974), followed by a soil inventory (Crown 1977), vegetation inventory (Techman Ltd. 1979), non-ungulate mammal inventory (Burns and Cool 1983) and the present avifauna inventory. Ungulates are inventoried on an ongoing basis and the Warden Service has compiled data on the ungulate resource during the last 60 years.

A preliminary avifauna Resource Description and Analysis was prepared by wardens Dave Gilbride and Olive Dodd and Environment 2000 employee Heather Gray during 1984, based on all data available prior to this inventory. Their summaries constitute the background information presented in the species accounts.

Because the Avifauna Inventory was designed as a two-year study to be conducted primarily by the Canadian Wildlife Service with completion in March 1986, this report cannot in any way be considered a final product. The data analysis presented below is based on incomplete and insufficient data and any management decisions based on this report could well prove incorrect. Since cutbacks to the Canadian Wildlife Service announced in November 1984 have eliminated the National Parks Research Section of CWS, the project as planned will terminate with the completion of this interim report.

Consequently, the authors have made every effort to include all the information on methodology, data gaps and proposed scheduling for further work that may be required to complete this project and provide a usable Avifauna Inventory. Some preliminary recommendations for avifauna management and monitoring are also included.

Continuity between this phase of the study and any subsequent work to complete the study will be facilitated by the active involvement of EINP wardens, particularly Normand Cool, during the 1984/85 season.

2. METHODS

2.1 Sampling Rationale

Sampling techniques were chosen on the basis of the following criteria:

1. They must sample all bird species.
2. They must provide quantitative data on habitat use, particularly for breeding birds.
3. They must minimize observer variability to produce statistically-sound data.
4. They must produce an adequate sample size, given limitations on availability of trained staff and project duration.
5. They must be designed so that project sampling can evolve naturally into a monitoring program to be carried out by seasonal park wardens.

No single technique can meet all these criteria. Thirteen methods for collecting data were applied in the first year of this study (see Tables 2.1 and 2.2).

A primary concern was the requirement for sampling techniques to be useful in a monitoring program after the end of the project. Since new seasonal wardens may be assigned the task of avifauna monitoring, there was a requirement to consider the effects of observer variability.

Observer variability has been shown repeatedly to be a major uncontrolled variable in bird studies, particularly those based on identification of songs and calls. No two observers have the same degree of skill at identification, the same acuity of hearing or vision, nor the

Table 2.1 Matrix of species groups sampled by various techniques.

	Loons, grebes, waterfowl	Shorebirds	Gulls, terns, herons, cormorants	Raptors (hawks, owls)	Grouse	Passerines, etc.
Spring migration surveys						
- aquatic	X	X	X	X		X
- terrestrial	X	X	X	X	X	X
Owl call surveys				X		
Raptor nest surveys				X		
Breeding bird surveys						
- colony searches	X		X			
- wetland surveys	X	X				X
- call-count surveys						X
- count plots						X
Autumn migration surveys						
- aquatic	X	X	X	X		
- terrestrial	X	X	X	X		X
Christmas bird counts				X	X	X
Winter transect counts*				X	X	X
Random observations	X	X	X	X	X	X

*Sampling abandoned due to insufficient personnel and time.

Table 2.2 Matrix of avifauna information provided by various techniques.

	Spring migration	Breeding birds	Autumn migration	Wintering birds	Habitat use	Relative abundance	Rare species/ critical habitats	Monitoring
Spring migration surveys								
- aquatic	X				X	X		X
- terrestrial	X			X		X	X	
Owl call surveys		X		X				X
Raptor nest surveys		X						
Breeding bird surveys								
- colony searches		X			X		X	X
- wetland surveys		X			X		X	
- call-count transects		X			X	X		X
- count plots		X			X	X	X	
Autumn migration surveys								
- aquatic			X		X	X		X
- terrestrial			X	X		X		
Christmas bird counts				X			X	X
Winter transect counts*				X	X	X		
Random observations	X		X	X	X		X	

*Sampling abandoned due to insufficient personnel and time.

same approach to sampling even when a method is clearly described. Since seasonal wardens are not likely to be the same individuals from one year to the next, observer variability could potentially confound attempts to compare one year's data with the next.

Thus there was a particular emphasis on use of methods that do not require high levels of accuracy with regard to identification of distant birds and estimation of distance, that do not require a great deal of training or sampling effort, but that will produce replicate results.

The methods selected are described below in detail.

2.2 Sampling Techniques and Data Analysis

2.2.1 Breeding bird transects

In sampling breeding bird populations one is confronted by a number of problems which must be resolved. Detectability of birds is variable from one species to the next and between sexes within the same species. Territorial vocalizations, by which birds are generally counted, peak only during a short period each day (usually near sunrise) and only for a short period each year. Exact locations of birds and plot boundaries are not always readily determined in dense vegetation. Not all birds are visible or vocal during a single transect coverage.

The primary method we used for sampling breeding birds was a fixed-width transect method modified from the method used by Skeel and Bondrup-Nielson (1978). The ideal of sampling every one of the 76 biophysical units described by Techman Ltd. (1979) was sacrificed in favour of a technique that would be statistically-sound, simple and readily adapted to a monitoring program.

Our fixed-width transect method was designed to minimize error from estimates or measurements and to be replicable.

Twenty locations were chosen for permanent transects. Each location represented one homogeneous vegetation type, or a complex of two vegetation types where the types do not occur in sufficiently extensive tracts in EINP. The vegetation types were those used by Techman Ltd. (1979) to describe biophysical units; each type was sampled on at least two transects, and the underlying assumption was that the results could be extrapolated to all biophysical units with similar vegetation.

Each transect was at least 500 m in length (Appendix 2). The longest transect was more than 3000 m long. The maximum width of a transect was 100 m (50 m on either side of the centre line).

In April and May 1984, with the aid of students from Lakeland College, all transects were flagged and mapped. Centre lines were marked with blue survey flagging at 50 m intervals. Lateral boundaries were flagged to allow the sampling team to locate the outer limits of each transect strip. Vegetation was mapped on grid paper to form the basis for field data sheets on which bird observations were subsequently plotted.

In July and August 1984 most of the transects were permanently marked with metal re-bar stakes driven to nearly flush with the ground surface at the first station, and with numbered 1 x 4 cm metal tags nailed at breast height to trees near each 50 m station along the centre line, or on 5 x 5 cm wooden stakes in open habitats. Detailed vegetation descriptions were also collected at five randomly selected stations along the centre lines. Transects through wetlands required a different

approach to permanently recording their locations. Transects are described in Appendix 2.

Transects were sampled between 28 May and 6 July. Sampling was not conducted on days when there was steady rain or winds exceeded Beaufort 4. All sampling was conducted between 0400 and 1000 h.

Each transect was sampled three or four times except transect 19 which was sampled only twice, due to its length. A sampling regime was set up such that each transect would be sampled once on the hour centered at sunrise, and once in each of the two or three succeeding hours. This ensured that species that sing mostly early in the morning were sampled at the same level of intensity as those whose singing peaks later. In addition, both of the principal observers sampled each transect at least once each year to minimize any bias and clear up any identification problems. An observer sampled a transect twice in one day, travelling the transect once in each direction. Each pair of samples of a transect was separated by three weeks from the other pair of transects to remove any bias for early or late season breeders.

On each transect coverage the observer travelled slowly along the center line, stopping at each 50 m station for a minimum of three minutes. All birds seen or heard were mapped on a field sheet. To minimize the possibility of recording the same bird twice, arrows were used to indicate when a bird changed position. Each bird was marked with a symbol describing behaviours such as singing, carrying food, or flying past. Singing or carrying food were considered to be expressions of territoriality. All birds were recorded, whether on the transect strip or off.

Data were subsequently transferred to Parks Canada Wildlife Survey Data Forms (WSDFs). Birds observed on the transect strip were indicated by survey type BT84 and territorial males were coded in the Adult Male column. Birds observed off the transect strip, including flyovers, were indicated by survey type PPB5.

A computer program was developed by Dr. Terry Taerum of the University of Alberta, to determine breeding bird densities from transect data. The maximum single count of territorial males of a species, out of the two to four counts for each transect each year, was taken as the actual number of territorial males resident on the transect strip. This approach gives a liberal estimate of breeding density since the repeated coverages increase the probability of recording birds whose territories lie primarily off the transect strip. It also assumes that all birds are 100% detectable within 50 m of the observer, and no detectability coefficient (Emlen 1971) or other adjustment was applied to the data.

2.2.2 Count plots

An additional method was required to allow the inventory team to sample as many as possible of the 76 biophysical units, cover as much as possible of the park's geographical area, and locate rare or unique bird species and habitats. By definition, then, this method had to be "quick-and-dirty", sacrificing statistical purity for widespread coverage.

The count plot method was essentially a point sampling technique. Between 0400 and 1020 h during the breeding season (28 May to 6 July), observers sampled as many count plots as possible, given the constraint that breeding bird transects had first priority.

The observer positioned himself either in the centre of a tract of relatively homogeneous vegetation representing a mapped biophysical unit or on a boundary between two biophysical units. The observer estimated the boundary of a circle of 50 m radius with the observer representing the centre of the circle. The portion of the circle falling within the vegetation type being sampled was recorded as a percentage. For example, if the observer was standing at the edge of a marsh with a straight shoreline extending to either side, he recorded 50; if he was in the middle of a solid poplar forest he recorded 99.

All birds seen or heard during the 3 to 5 minute sampling period were tallied and recorded on WSDFs. Those that were within the count plot were indicated by survey type CP84. Those that were beyond the 50 m radius were indicated by survey type PPB5. Birds seen or flushed on the approach to or departure from the count plot center were recorded as well.

A computer program was developed to estimate density of breeding birds from count plot data. The approach was similar to that used for breeding bird transects, but area was calculated as the recorded percentage of a circle of radius 50 m (area 7875 m^2). Results were used in part to test the validity of extrapolations from breeding bird transect results to biophysical units not sampled by transects.

2.2.3 Winter bird sampling

Attempts to survey habitat use by wintering birds by sampling transects in a manner similar to that described for breeding birds were abandoned in December. Due to the very low densities of most species in

winter, an impossibly large sample size is required to record enough observations to analyze statistically.

Consequently, it was agreed that the most feasible means for monitoring winter bird use was to conduct annual Christmas Bird Counts as part of an international program coordinated by the American Ornithologists' Union. Trends in wintering bird popuations in the area can be monitored by annual reviews of regional Christmas Bird Counts which are published in American Birds.

In 1983 and 1984 Normand Cool of the EINP Warden Service and Dr. Geoff Holroyd of the Canadian Wildlife Service jointly coordinated Christmas Bird Counts in Elk Island National Park.

2.2.4 Spring migration surveys

Migration surveys were conducted to determine the timing and magnitude of spring migration. A single route was covered twice each week from the beginning of April until the first week in June. The route was designed to sample both terrestrial and aquatic birds.

The survey route began at Astotin Lake northwest of the Park Administration area and consisted of 50 roadside stops along the roads along the west and north boundaries, the main park road, and the road to the Isolation Area Warden Station. Stops were located such that all major park habitats were represented on the route. Stops varied from 0.3 to 1.5 km apart. All stops were marked with white painted numbers on fenceposts, road verges, or survey stakes 10 m west of the road verge.

Surveys began 0.5 h before sunrise and lasted about four hours. At each stop, one or two observers remained stationary for three minutes and recorded all birds seen or heard.

The total individuals of each species was recorded for each survey on a running tally sheet at the Park Warden headquarters. Habitat data were assembled in July and analysed by hand. Due to the sheer volume of data (which would have required 50 WSDFs and resulted in up to 750 lines of computer data for each day of sampling) data were not computerized. All raw data and summaries comprise part of this interim report.

2.2.5 Autumn migration surveys

Because autumn migrants are considerably less detectable than spring migrants, it proved necessary to survey them by a different method. The autumn survey involves scanning waterbodies from fixed locations, as well as counting birds along transect lines. The method provides some data on peak migration times but at a considerably lower level of confidence than the spring migration surveys. It does provide good data on earliest and latest dates of appearance of various species and observational data on habitat preferences of autumn migrants.

The survey route was in four portions. Beginning at 0830 h the observer walked from the canoe concession at Astotin Lake, along the Lakeside Trail to the boat launch, and then returned through the picnic and parking areas. The shore and the nearest islands were surveyed in addition to the forested area and recreation grounds.

Beginning at 1000 h the observer walked the Lakeview Nature Trail, again counting all terrestrial birds, flyovers and water birds between the shore and the nearest islands.

Beginning at 1300 h the observer counted all water birds in the bay visible from the observation platform at Tawayik Lake Day-use Area. The observer then travelled by foot along an abandoned trail to a point overlooking the northwest corner of Tawayik Lake (UTM: UQ756417). At this point all water birds north and east of an imaginary line extending from the point of land at UTM: UQ760416 to an open meadow at about UTM: UQ749411 were counted with the aid of a Bushnell 20 x 45 variable spotting scope. The observer then continued north to station 10 on breeding bird transect #2 and followed the transect out to Oster Road. All terrestrial birds and flyovers were counted.

Beginning at 1500 h the observer walked or drove slowly from the gate at UTM: UQ805372 along the Goose Lake road to the end of breeding bird transect #20. All water birds and shorebirds on the north and east arms of Goose Lake were tallied, as were all terrestrial birds and flyovers.

All data were coded directly onto a set of 15 WSDFs, survey type FMS1. Biophysical (card 5) data were not recorded.

2.2.6 Spring and fall water bird surveys

Water bird surveys were conducted in the spring from April 13 to May 23, 1984 and in the fall from August 14 to October 26, 1984. Kemper's (1974) wetland classification was utilized for the selection of waterbodies. A total of 20 waterbodies was surveyed in the spring. Nine

of these waterbodies were surveyed again with five additional areas for a total of 14 waterbodies during the fall.

The park biophysical map and aerial photos were utilized to locate waterbodies that would be representative of all wetland types. All areas were then examined to verify that they represented the range of types in Kemper's classification system. A diagram outlining the contour of each waterbody to be surveyed was used as a field sheet to record bird observations. A single viewpoint was selected on each waterbody which would give the best view of the entire area being sampled. Landmarks along shorelines, such as beaver lodges, terrain, and vegetation tracts were used to delineate imaginary boundaries across large open waterbodies such as Astotin Lake, which were too large to view from one vantage point.

All sightings were recorded on WSDFs under survey type PPB5 for spring surveys and survey type FMS2 for fall surveys. Each waterbody was assigned a single UTM coordinate to facilitate data recording.

During the spring survey all bird sightings were transcribed on the field sheet maps and then transferred to wildlife survey forms. This proved to be time consuming and the field sheet maps were discontinued for the fall survey.

New species codes were created for ducks that were unidentifiable. Ducks that could not be identified to species were classified as diving ducks (DIDU) or dabbling ducks (PUDU). Ducks that were not distinguishable were entered as DUCK (unidentified duck).

Survey data were analyzed in two ways. Survey totals for each species were recorded on each day of sampling to produce a graph illust-

rating first arrival, last departure, and peak migration periods. In addition, the actual area of each water body was measured with a Hewlett Packer digitizer/planimeter and average densities of each species on each of Kemper's (1974) wetland types were calculated as follows:

$$\text{Density (\#/100 ha)} = \frac{\text{total number observed on all surveys} \times 100}{\text{total number of surveys} \times \text{area of wetland type surveyed}}$$

2.2.7 Summer wetland surveys

During June and July, 34 wetlands were surveyed for waterfowl and other water-associated birds. An initial selection of 10 wetlands was mapped and their areas calculated. Each was surveyed once by either walking around the periphery of the wetland or by scanning it from a single location. One hour was the maximum amount of time spent surveying each location. Total counts of each species were divided by total area of each wetland type to determine summer densities.

A further 24 wetlands were surveyed in a similar manner but their areas were not determined and the data were thus used only to indicate presence rather than to calculate densities. All birds seen or heard were recorded on a hand-sketched map of the waterbody and records were later transferred to wildlife survey forms under survey type PPB5.

2.2.8 Raptor survey

A raptor survey was instituted during May and June 1984 to document habitat use by raptors. The survey dealt mainly with locating raptor nests (either active or inactive) and recording raptor sightings.

All raptor nests and sightings were recorded on a park biophysical map. Cross-country ski trails, park boundaries, and management roads were covered by foot. All observations were directly encoded on WSDFs under survey type PPB5. These data, which were collected by a group of student volunteers from the Lamont High School Biology Club, were added to a compilation of raptor records from the CANSIS computer files. Observations of raptors and raptor nests were then tallied by habitat (biophysical unit). Because of the low densities of raptors and their low detectability, no standardized survey technique could be designed.

2.2.9 Colonial bird surveys

To assess the distribution, abundance and habitat utilization of cormorants, herons, bitterns, gulls and terns, the park's library and CANSIS data files were searched for records of these birds. Waterbodies for the surveys were then selected on the basis of available records. Lakes, including islands and shorelines, and marshes were surveyed between May 14 and October 12, 1984. The surveyed waterbodies included Astotin Lake (including all islands and shorelines), Blackfoot Lake (east and west sections, including islands), Spruce Island Lake, Tawayik Lakes, and the marshes bordering both Astotin and Moss lakes. A canoe was used to cover the lakes. Islands were searched on foot.

Observations, including flight direction of flying birds, were recorded on a biophysical map and were later transferred to WSDFs with survey type coded PPB5. Nest locations were also recorded on CWS prairie nest record cards.

2.2.10 Monitoring techniques

The feasibility of modifying the migration surveys and breeding bird transects to develop procedures that could be used by EINP resource conservation staff to monitor bird populations was investigated.

Variability in numbers of each species recorded from one coverage of a migration survey to the next was studied to assess which species are most reliably sampled by the techniques and how many coverages are required were examined to determine which species are most consistently recorded and which time period produces the greatest proportion of records of species and individuals. This analysis is ongoing and will only be completed following collection of another field season's data. Further details are in Appendix 3.

3. RESULTS

3.1 Breeding Bird Transects

Twenty permanent breeding bird transects were surveyed, marked and sampled in 1984. A sampling schedule was followed to ensure that each transect was sampled at least once by the two principle observers and that each transect was sampled both early and late in the season and at least once at sunrise.

A total of 96 species was recorded on transects. The species with the highest frequency (recorded on the largest number of transects) were:

Brown-headed Cowbird	(17)
White-throated Sparrow	(15)
Least Flycatcher	(13)
American Robin	(13)
Pine Siskin	(11)
Red-winged Blackbird	(11)
Red-eyed Vireo	(11)
Tree Swallow	(10)
Common Yellowthroat	(10)
Clay-colored Sparrow	(10)

The species with the greatest abundance based on cumulative densities on breeding bird transects were:

Least Flycatcher	14.2
Red-winged Blackbird	9.7
Brown-headed Cowbird	9.6
White-throated Sparrow	8.6

Savannah Sparrow	5.6
Red-eyed Vireo	4.3
Clay-colored Sparrow	3.9
Chipping Sparrow	3.9

This is a very coarse estimate of overall abundance in that there is no weighting factor for the areal extent of the habitat types sampled by each transect. Such a weighting factor cannot be applied with the existing biophysical data base because of biophysical map base inaccuracies (Appendix I).

Diversity indices were calculated for each transect based on Brillouin's formula (Schemnitz 1980) which is best suited to cases where absolute counts (census) of individuals are to be compared. It was felt that this formula was appropriate for our data since sampling effort was generally comparable and the multiple coverages of each transect approximate an absolute count.

Transects having the highest breeding bird diversity are those where two physiognomically different habitats are intermingled (Table 3.1.1). The highest diversity was on transect 17 in the mixed deciduous/coniferous forest (mapped as P/S) south of Astotin Lake. Similar habitat was sampled on Long Island (F/P) and this transect also supported a high diversity of breeding birds. The other two transects with the highest diversity were transects 18 and 14, both with a mixture of wetland and terrestrial habitats.

The transects having the lowest breeding bird diversity were those on hay meadow (12 and 13) and in continuous poplar forests (3 and 4). As has been noted in many other areas, bird diversity appears to be directly

Table 3.1.1. Elk Island National Park transect results (listed in descending order of diversity).

Transect No.	Diversity* index	No. of species	Density of birds/ha	Biophysical codes	Dominant habitat
17	4.14	23	10.6	P/S	Mixed/spruce/aspen
18	2.95	25	12.2	C/S	Sedge/willow marsh
14	2.80	30	13.0	S/P	Shrub/poplar open
16	2.65	20	6.1	F/P	Mixed spruce/poplar
10	2.49	19	8.5	P	Poplar
7	2.37	18	5.8	M	Muskeg
11	2.32	18	5.8	G	Grassland/poplar
15	2.31	20	8.2	P/G	Poplar
1	2.30	18	7.0	G/P	Poplar (burned)
6	2.30	20	5.2	M	Muskeg
8	2.24	18	8.6	G/P	Poplar
5	2.14	16	5.2	P/S	Poplar (burned)
2	2.08	13	5.6	G/P	Poplar
9	2.08	17	5.4	G/P	Poplar
20	2.07	31	21.4	C/T	Sedge/cattail marsh
4	2.06	15	6.8	P/S	Poplar
3	2.03	14	4.8	G/P	Poplar
13	1.63	12	6.6	A	Hay meadow
12	1.18	8	3.2	A	Hay meadow

*Diversity index is based on Brillouin's formula (Schemnitz 1980; p. 271), applied to densities expressed as birds/10 ha.

related to habitat diversity, and when habitats become simplified and homogenous either through cultivation or other forms of disturbance, or through vegetation succession and in-filling, bird diversity decreases.

A cluster analysis (Fig. 3.1.1) of the 20 transects appears to indicate that there are no significant differences among most poplar-dominated habitats. The two transects (2 and 5) that had been recently burned were as similar to other unburned habitats as to one another. Transects having a coniferous vegetation component (6, 7, 16, 17) are all relatively similar to one another. The wetland-associated transects were essentially unique relative to one another.

The weak results of the cluster analysis, particularly in regard to poplar-dominated transects, indicate that a second year's data is required to clarify the relationships among the transects. The inability of the cluster analysis to group transects which are mapped and classified by Techman Ltd. (1979) as similar biophysical units appears to indicate a lack of internal consistency in the biophysical classification. Another aspect of the problem may be that a 500 m or longer transect samples several habitats in an area like EINP where terrain and vegetation are highly heterogenous. Both the scale of the biophysical classification and the scale at which the birds are sampled might better be at a smaller scale (e.g. 1:5,000), but any attempt to sample birds at this scale will be confounded by edge effect. An accurate and internally-consistent biophysical classification is most likely to clarify these problems.

Nonetheless, it is anticipated that monitoring of these permanent transects to detect between-year changes in bird densities (rather than between-habitat variability) will be practical and valid.

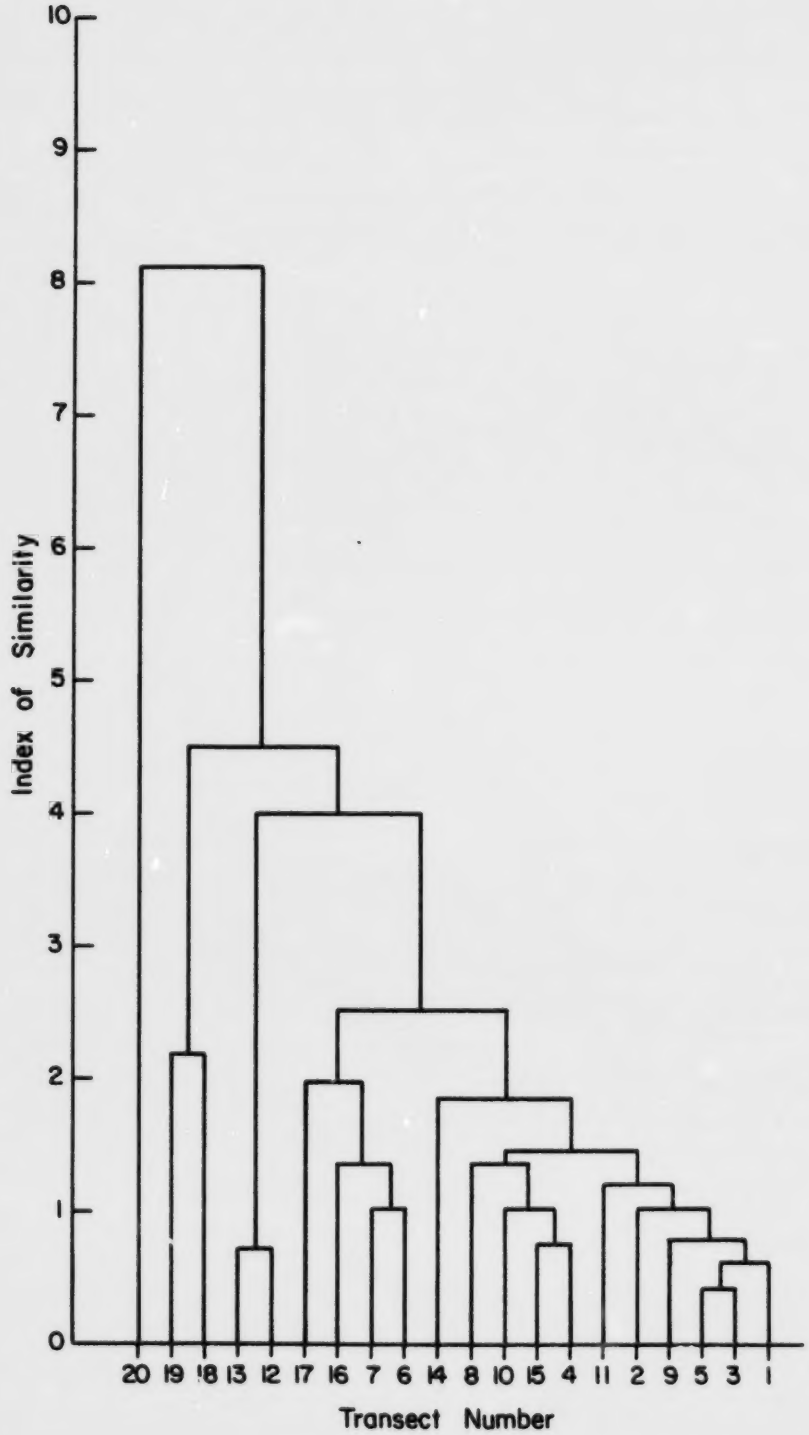

Figure 3.1.1. Clustering of transects based on similar bird faunas.

3.2 Count Plots

Twenty vegetation types and 78.7 ha were sampled by count plots in 1984 (Table 3.2.1). Ninety species of birds were recorded by this sampling method. The amount of sampling was probably sufficient in only two vegetation types - GP and PS (Fig. 3.2.1). The number of recorded species increased until the area sampled reached about 10 ha and then further sampling apparently produced few new species. This suggests that at least 10 ha of sample area is required before count plots will account for the majority of territorial species occupying a habitat. In a continuation of the present inventory, priority in count plot sampling should be given to increasing the areas sampled, particularly in habitats not treated by transects.

Four vegetation types which received the most sampling give a useful picture of bird distribution by habitat. In the aspen forests (PS), the Least Flycatcher was the most common species (1.5 territories/ ha), while the Brown-headed Cowbird was second in abundance (0.7 males /ha), the American Robin was third (0.5 territories/ha) and the Veery, White-throated Sparrow and Yellow Warbler were tied at fourth in abundance (0.40/ha). In the parkland habitats (GP), the Least Flycatcher was the most abundant species (1.2 territories/ha) while the Mourning Warbler, Clay-colored Sparrow and White-throated Sparrow were second in abundance (0.34/ha) and the American Robin, Brown-headed Cowbird and Common Yellow-throat were third in abundance (0.27/ha). In the more open parkland (G), the Song Sparrow was most abundant (0.57/ ha) followed by the American Robin (0.43/ha) and the House Wren, Black-capped Chickadee, Alder Flycatcher and American Goldfinch (0.29/ha). In the sedge wetlands

Table 3.2.1. Sampling effort in count plots during the 1984 field season.

Vegetation type	Area sampled (ha)	Number of species recorded	
		Territorial	Other
A	3.5	5	3
CS	7.2	32	5
D	3.1	7	0
FP	0.8	4	2
F	1.6	6	10
GP	14.8	25	3
GS	1.6	3	0
G	7.0	19	3
LA	0.9	3	2
MS	1.9	14	3
M	5.1	14	4
PF	5.5	12	6
PG	0.9	11	2
PM	1.2	9	2
PS	15.1	32	7
SC	2.3	13	10
SP	0.8	9	1
S	3.8	20	5
TC	0.3	1	1

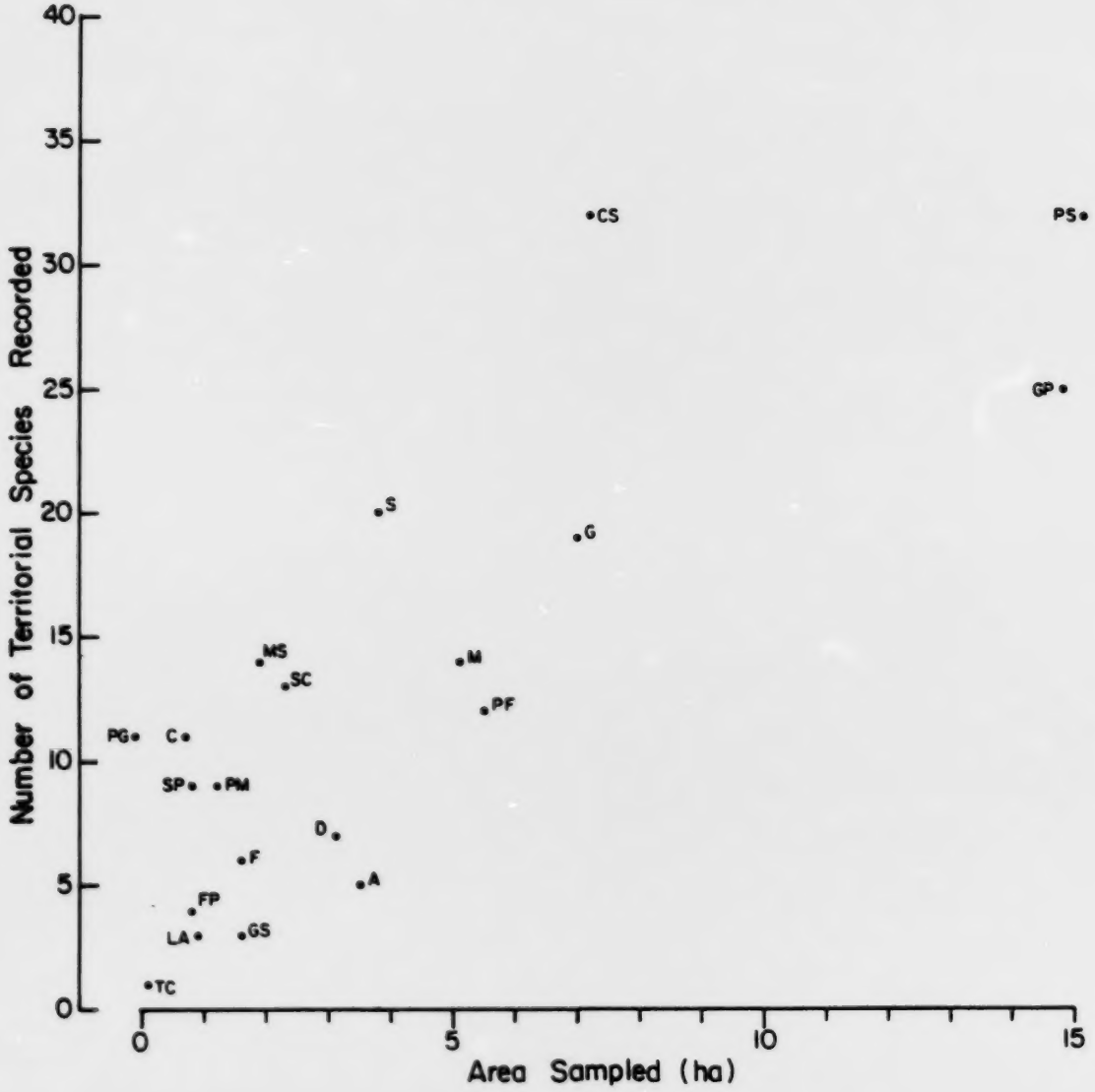

Figure 3.2.1. Number of territorial species recorded and area sampled by count plots in 20 vegetation types.

(CS), the Red-winged Blackbird was the most abundant species (3.2 territories/ha), the Blue-winged Teal was second in abundance (2.2/ha) and the Mallard was third (1.9/ha).

The most abundant, widespread or habitat-tolerant species was the Red-winged Blackbird which appeared in 11 of the 20 vegetation types sampled. The Song Sparrow and Lincoln's Sparrow both appeared in 10 vegetation types. The Clay-colored Sparrow and Common Yellowthroat were each recorded in nine vegetation types. Suggesting habitat specificity or rarity, the American Bittern, Barrow's Goldeneye, Blue Jay, Barn Swallow, Common Grackle, Common Loon, Downy Woodpecker, Forster's Tern, Golden-crowned Kinglet, Gray Catbird, Green-winged Teal, Horned Grebe, Merlin, Pileated Woodpecker, Purple Martin, Redhead, Red-tailed Hawk, Ruby-throated Hummingbird, Song Sparrow, Solitary Vireo, Swainson's Thrush and Veery were recorded in only one vegetation type.

The insufficiency of sampling in several vegetation types was apparent in the results of the cluster analysis (Fig. 3.2.2). Two sets of vegetation types were suggested: one consisting only of vegetation type SP and the other set consisting of the remaining 19 vegetation types. The large cluster was therefore made up of such different habitats as lakes, sedge wetlands, bogs, parkland, aspen forest, agricultural land and white spruce forest. Within this large cluster, some logical linkages were found (A and G, PS and GP and lake and CS) and these linkages tended to involve vegetation types which were well sampled by count plots.

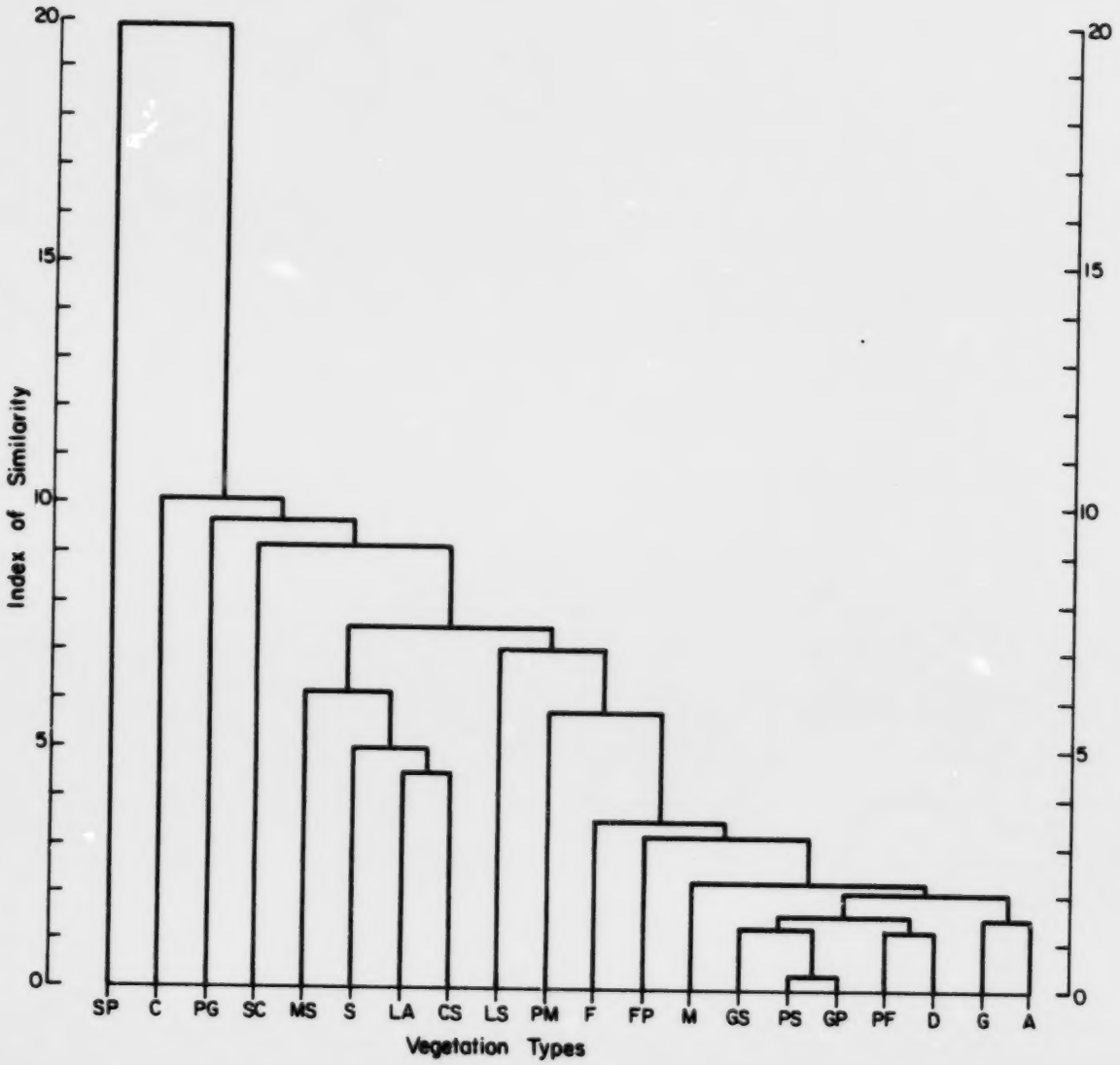

Figure 3.2.2. Clustering of vegetation types based on similar bird faunas as recorded in count plots.

3.3 Spring Migration Survey

A total of 131 species was recorded during the 17 surveys. The number of species recorded on a single survey increased from 14 on 3 April to 87 on 30 May (Table 3.3.1).

Three species were new for Elk Island National Park: Virginia Rail (one, on 18 May), Rough-winged Swallow (one, on 26 and 30 May) (Table 3.3.2). Other highlights included 550 White-fronted Geese on 30 April, a maximum count of 19 drumming Ruffed Grouse on 27 April, a male Varied Thrush on 11 May and four male Chestnut-sided Warblers on 30 May. At least one Chestnut-sided Warbler remained on territory in the park throughout June and July.

Early migrants such as most waterfowl species, Red-tailed Hawk, American Robin, Starling, Dark-eyed Junco, Red-winged Blackbird and Western Meadowlark increased in numbers steadily throughout April. Winter residents (Snow Bunting, Bohemian Waxwing) and very early migrants (Horned Lark, Tree Sparrow) were not recorded after mid-April.

Two major migration surges were noted. The first big wave of sparrows appeared about 25 April. Species recorded from late April on included Swamp, Song and Lincoln's Sparrow, as well as Tree Swallow, Yellow-bellied Sapsucker and Yellow-rumped Warbler.

Other species arrived gradually until 13 May, when a major influx of insectivorous species arrived. During the following week, a period of wet, overcast weather, large numbers of Least Flycatcher, Barn Swallow, Warbling Vireo, Tennessee, Orange-crowned, Yellow, Palm, Blackpoll, Yellow-rumped and Connecticut Warblers. Ovenbird, Leconte's, White-

Table 3.3.1. Spring migration survey summary, 1984.

Survey date	Total no. species	Total no. individuals
April 3	24	421
5	28	416
10	32	798
12	30	433
16	35	551
19	43	751
24	39	508
27	50	853
30	52	1471
May 6	58	947
9	48	730
11	59	1017
15	63	765
18	75	935
22	81	1112
26	86	1189
30	87	1070

Table 3.3.2. Earliest records* and maximum counts of species recorded on the Elk Island migration survey route, spring 1984.

Species	Earliest record	Maximum count
Common Loon	16 April	4
Pied-billed Grebe	19 April	4
Horned Grebe	27 April	10
Red-necked Grebe	16 April	46
Eared Grebe	24 April	3
Double-crested Cormorant	26 May	15
American Bittern	26 May	1
Great Blue Heron	30 April	1
Black-crowned Night Heron	30 May	3
Tundra Swan	10 April	49
White-fronted Goose	30 April	550
Canada Goose	3 April	229
Green-winged Teal	10 April	40
Mallard	5 April	111
Northern Pintail	5 April	42
Blue-winged Teal	19 April	21
Northern Shoveler	16 April	4
Gadwall	30 April	7
American Wigeon	5 April	36
Canvasback	19 April	4
Redhead	27 April	4
Ring-necked Duck	16 April	22
Lesser Scaup	12 April	44
Common Goldeneye	10 April	18
Bufflehead	10 April	27
Common Merganser	6 May	2
Ruddy Duck	6 May	3
Bald Eagle	5 April	1
Northern Harrier	10 April	1
Sharp-shinned Hawk	19 April	1
Cooper's Hawk	6 May	1
Broad-winged Hawk	27 April	2
Red-tailed Hawk	5 April	7
Ruffed Grouse	3 April	19
Virginia Rail	18 May	1
Sora	18 May	9
American Coot	27 April	15
Killdeer	10 April	5
Lesser Yellowlegs	19 April	34
Solitary Sandpiper	22 May	4
Spotted Sandpiper	11 May	5
Baird's Sandpiper	6 May	2
Common Snipe	19 April	34

Table 3.3.2. Continued.

Species	Earliest record	Maximum count
Franklin's Gull	18 May	2
Bonaparte's Gull	30 April	109
Ring-billed Gull	12 May	8
Common Tern	22 May	2
Forster's Tern	26 May	1
Black Tern	22 May	13
Mourning Dove	27 April	14
Great Horned Owl		10
Ruby-throated Hummingbird	30 May	1
Yellow-bellied Sapsucker	24 April	37
Downy Woodpecker		5
Hairy Woodpecker		4
Northern Flicker	24 April	12
Pileated Woodpecker		15
Olive-sided Flycatcher	30 May	1
Western Wood Peewee	18 May	8
Least Flycatcher	15 May	79
Eastern Phoebe	19 April	4
Eastern Kingbird	22 May	2
Horned Lark	3 April	64
Tree Swallow	24 April	41
Rough-winged Swallow	22 May	1
Barn Swallow	15 May	7
Blue Jay		22
Black-billed Magpie		9
American Crow	3 April	40
Black-capped Chickadee		47
Boreal Chickadee		3
Red-breasted Nuthatch	27 April	2
White-breasted Nuthatch	3 April	11
House Wren	22 May	9
Marsh Wren	26 May	1
Ruby-crowned Kinglet	16 April	8
Mountain Bluebird	3 April	2
Veery	22 May	2
Swainson's Thrush	18 May	1
Hermit Thrush	27 April	14
American Robin	3 April	126
Varied Thrush	11 May	1
Bohemian Waxwing	3 April	6
Cedar Waxwing	30 May	2
European Starling	3 April	60
Warbling Vireo	15 May	5
Philadelphia Vireo	30 May	12
Red-eyed Vireo	18 May	14

Table 3.3.2. Continued.

Species	Earliest record	Maximum count
Tennessee Warbler	15 May	24
Orange-crowned Warbler	11 May	48
Yellow Warbler	15 May	4
Chestnut-sided Warbler	30 May	4
Magnolia Warbler	26 May	1
Yellow-rumped Warbler	19 April	17
Palm Warbler	26 May	1
Blackpoll Warbler	18 May	5
American Redstart	22 May	5
Ovenbird	18 May	13
Northern Waterthrush	18 May	4
Connecticut Warbler	15 May	2
Mourning Warbler	30 May	1
Common Yellowthroat	18 May	12
Wilson's Warbler	22 May	2
Western Tanager	30 May	2
Rose-breasted Grosbeak	18 May	16
American Tree Sparrow	3 April	18
Chipping Sparrow	15 May	42
Clay-colored Sparrow	15 May	48
Savannah Sparrow	30 May	7
LeConte's Sparrow	15 May	8
Song Sparrow	16 April	35
Lincoln's Sparrow	27 April	22
Swamp Sparrow	24 April	26
White-throated Sparrow	19 April	99
Dark-eyed Junco	5 April	71
Snow Bunting	3 April	46
Red-winged Blackbird	10 April	301
Western Meadowlark	3 April	3
Yellow-headed Blackbird	30 May	4
Brewer's Blackbird	10 April	6
Common Grackle	12 April	26
Brown-headed Cowbird	9 May	86
Northern Oriole	15 May	23
Purple Finch	19 April	20
Pine Siskin	12 April	16
American Goldfinch	26 May	5
Evening Grosbeak	3 April	14
House Sparrow		2

*Several species were recorded at earlier dates at locations other than the survey route. Earliest record is not given for permanent residents.

throated, Chipping and Clay-colored Sparrows, Rose-breasted Grosbeak and Northern Oriole were recorded.

There were few new arrivals during the continued cool, wet weather of late May. Veeries were first recorded on 22 May, a month after the first Hermit Thrushes. The first Double-crested Cormorants and American Bittern were observed on 17 and 26 May, and Black-crowned Night Herons were first observed on 30 May. Species which arrived in the park at the end of May and during the first week of June, after the migration surveys were completed, included Ruby-throated Hummingbird, Cedar Waxwing and Sharp-tailed Sparrow.

Timing of migration appeared to be related to phenological events in the habitat. Tree Sparrows and Horned Larks arrived when the first patches of bare ground opened up; similarly, waterfowl began to appear as soon as small patches of open water appeared along the edges of sloughs and lakes. Peak numbers of migrant waterfowl corresponded with the final disappearance of ice from waterbodies. The first surge of sparrows correlated with the period when snow cover was rapidly ablating and the first green grass and willow catkins were appearing. The major influx of insectivorous species on 13 May coincided with the development of a full aspen canopy, and most migrants during the following week were seen in the aspen canopy. On 17 May, near Astotin Lake, a single aspen bluff contained 8 Yellow-rumped Warblers, 3 Yellow Warblers, 2 Blackpoll Warblers, 3 Least Flycatchers, 2 Clay-colored Sparrows, a pair of Rose-breasted Grosbeaks, 30 Red-winged Blackbirds and 20 Tree Swallows. All were feeding on large moths in or adjacent to the tree canopy.

Although the park is considered a southern outlier of the Boreal ecoregion, there was a notable scarcity of boreal passerines. This may be partly due to the barrier posed by the prairie regions to the south to boreal migrants (A.J. Erskine, pers. comm.). No Black-throated Green, Black-and-White, Cape May, or Bay-breasted Warblers were observed in migration. Northern Waterthrushes and Palm Warblers were observed during the last quarter of May but did not remain to breed. One singing male Black-and-White Warbler was observed in mid-June. In most respects both the spring migration and the breeding population do not appear to differ markedly from those of the surrounding Aspen Parkland Ecoregion (Salt and Salt 1976).

3.4 Fall Migration Survey

A total of 129 species was recorded during the 23 surveys. There was no consistent pattern of increase or decrease in numbers of individuals during the survey period (Table 3.4.1) This may have been due, in part, to the fact that various species migrate from and through the park at different times, and to the fact that the survey methodology was less clearly standardized than the spring survey and thus allowed for greater variability in sampling effort and accuracy. Where peak numbers were recorded (early September, early October) only a few species (e.g. American Coot, Bank Swallow, Lesser Scaup, Mallard) contributed the vast majority of the individuals recorded. The number of species recorded on each survey gradually declined after late August.

No species were recorded that had not been previously found in EINP. Highlights included:

Table 3.4.1. Fall migration survey summary - 1984.

Survey date		Total no. species	Total no. individuals
July	20	47	1082
	23	44	702
	27	61	845
	30	50	1310
August	3	63	1504
	7	52	817
	10	46	731
	14	59	1367
	17	49	1322
	21	61	1778
	24	61	1348
	28	35	2037
	31	43	1882
September	4	41	1941
	10	55	2872
	14	44	1971
	17	25	1569
October	1	31	1464
	5	33	1286
	9	32	1829
	15	28	1293
	22	32	2219
	29	4	6

- 87 White-fronted Geese migrated over the park on August 24 (Table 3.4.2)
- up to 107 Barrow's Goldeneye were recorded during surveys in October. Most of these were on Goose Lake, with a small proportion on Tawayik Lake. This species may have been present earlier than October and been misidentified as Common Goldeneye since observers were not expecting it.
- a single male Wood Duck was recorded at the Astotin Lake recreation area on September 10 and again one week later. This is only the second recorded observation for the park.
- 142 Sandhill Cranes were seen flying over the park on September 10; 18 were recorded four days later.
- The only small Sandpipers recorded on fall migration surveys were a Baird's Sandpiper on August 3 and a Least Sandpiper on August 10.

Most insectivorous species (warblers, vireos and some sparrows) were not recorded after the second week of September. A few species, such as Least Flycatcher, Yellow Warbler, Red-eyed Vireo, Northern Oriole and Common Grackle were not recorded after the fourth week in August. Others, including the Yellow-rumped Warbler, White-throated Sparrow and Song Sparrow, remained until the beginning of October.

By October 5 less than 25% of the aspen canopy remained and by October 9, following two windy days, only a very few leaves remained. This period was also the time when the earliest Tree Sparrows and Common Redpolls were observed.

Table 3.4.2. Maximum counts and latest records* of species recorded on the Elk Island migration survey route, fall 1984.

Species	Latest record	Maximum count
Common Loon	7 August	3
Pied-billed Grebe	22 October	6
Horned Grebe	22 October	59
Red-necked Grebe	22 October	54
Eared Grebe	22 October	157
Western Grebe	5 October	8
Double-crested Cormorant	10 September	4
American Bittern	3 August	1
Great Blue Heron	14 September	1
Black-crowned Night Heron	10 September	5
Tundra Swan	22 October	52
Greater White-fronted Goose	24 August	45
Canada Goose	22 October	102
Wood Duck	17 September	1
Green-winged Teal	15 October	19
Mallard	22 October	450
Northern Pintail	22 October	3
Blue-winged Teal	9 OCtober	69
Northern Shoveler	9 October	52
Gadwall	15 October	17
American Wigeon	22 October	350
Canvasback	9 October	30
Redhead	17 September	14
Ring-necked Duck	1 October	40
Lesser Scaup	22 October	500
White-winged Scoter	9 October	6
Common Goldeneye	22 October	120
Barrow's Goldeneye	22 October	107
Bufflehead	22 October	52
Common Merganser	10 September	1
Ruddy Duck	22 October	1
Bald Eagle	22 October	1
Northern Harrier	17 August	1
Sharp-shinned Hawk	17 September	1
Broad-winged Hawk	24 August	1
Red-tailed Hawk	14 September	2
American Kestrel	5 October	1
Merlin	15 October	1
Ruffed Grouse	29 October	1
Sora	31 August	3
American Coot	15 October	317
Sandhill Crane	14 September	140
Killdeer	9 October	7

Table 3.4.2. Continued.

Species	Latest record	Maximum count
Greater Yellowlegs	22 October	6
Lesser Yellowlegs	4 September	10
Solitary Sandpiper	24 August	6
Spotted Sandpiper	17 September	3
Least Sandpiper	10 August	1
Baird's Sandpiper	3 August	1
Pectoral Sandpiper	17 September	15
Common Snipe	14 August	3
Wilson's Phalarope	21 August	4
Red-necked Phalarope	24 August	219
Franklin's Gull	9 October	7
Bonaparte's Gull	22 October	123
Ring-billed Gull	15 October	79
California Gull	30 July	1
Common Tern	4 September	25
Forster's Tern	27 July	1
Black Tern	24 August	78
Belted Kingfisher	14 September	1
Yellow-bellied Sapsucker	4 September	2
Downy Woodpecker	22 October	2
Hairy Woodpecker	9 October	1
Northern Flicker	14 September	1
Pileated Woodpecker	22 October	1
Western Wood Pewee	24 August	2
Least Flycatcher	24 August	4
Eastern Phoebe	24 August	2
Eastern Kingbird	10 September	3
Horned Lark	14 September	2
Purple Martin	14 August	4
Tree Swallow	14 August	35
Bank Swallow	10 September	500
Cliff Swallow	17 September	6
Barn Swallow	10 September	100
Blue Jay	29 October	3
Black-billed Magpie	22 October	25
American Crow	17 September	3
Black-capped Chickadee	29 October	20
Boreal Chickadee	22 October	2
Red-breasted Nuthatch	14 September	2
White-breasted Nuthatch	22 October	1
Brown Creeper	22 October	3
House Wren	28 August	3
Golden-crowned Kinglet	22 October	2
Ruby-crowned Kinglet	14 September	1
Swainson's Thrush	17 September	1

Table 3.4.2. Continued.

Species	Latest record	Maximum count
Hermit Thrush	30 July	1
American Robin	1 October	4
Gray Catbird	10 September	1
Cedar Waxwing	10 September	12
European Starling	9 October	25
Solitary Vireo	21 August	1
Red-eyed Vireo	28 August	3
Tennessee Warbler	24 August	2
Yellow Warbler	10 September	7
Yellow-rumped Warbler	5 October	7
Palm Warbler	10 September	3
Black-and-white Warbler	10 September	1
Common Yellowthroat	14 September	4
American Redstart	10 September	3
Ovenbird	14 September	3
Common Yellowthroat	3 August	4
Western Tanager	23 July	1
Rose-breasted Grosbeak	30 July	1
American Tree Sparrow	29 October	5
Chipping Sparrow	17 September	10
Clay-colored Sparrow	10 September	10
Savannah Sparrow	1 October	2
LeConte's Sparrow	10 August	1
Sharp-tailed Sparrow	27 July	1
Song Sparrow	22 October	5
Lincoln's Sparrow	10 September	1
Swamp Sparrow	7 August	1
White-throated Sparrow	17 September	7
Harris' Sparrow	5 October	2
Dark-eyed Junco	22 October	16
Snow Bunting	15 October	22
Red-winged Blackbird	14 August	19
Common Grackle	24 August	35
Brown-headed Cowbird	27 July	1
Northern Oriole	21 August	4
Pine Grosbeak	1 October	2
Purple Finch	14 September	1
Red Crossbill	22 October	5
White-winged Crossbill	10 September	2
Common Redpoll	29 October	25
Pine Siskin	15 October	20
American Goldfinch	14 September	50
Evening Grosbeak	7 August	2
House Sparrow	21 August	2

*A total of 133 species recorded.

On October 22 an ice rim was present around the edges of bays in the large lakes and some of the smaller ponds were completely covered with a thin layer of ice. There was a major freeze and snowfall during the following week and by October 29 all the park waterbodies were frozen over and there was 100% snow cover. The result of this catastrophic weather event was to abruptly terminate the fall migration; there were 2,219 individuals of 32 species recorded on October 22 and only six individuals of four species on October 27.

The onset of winter in 1984 was about three weeks earlier than normal. Another year's fall migration survey data may be required to produce a more typical picture of the autumn migration in Elk Island National Park.

3.5 Winter Bird Sampling

A Christmas Bird Count centered in Elk Island National Park was initiated in December 1983. This winter bird survey was repeated in December 1984 (Table 3.5) Sixteen species were recorded in both 1983 and 1984. Four species were recorded only in 1983 and six species were recorded only in 1984. The most abundant birds in the counts were the Blue Jay, Black-billed Magpie, Black-capped Chickadee, Snow Bunting, Evening Grosbeak and House Sparrow. The large numbers of these species are probably not representative of park winter populations but rather are indicative of concentrations at bird feeders and in agricultural land surrounding the park.

Table 3.5. Birds observed during the Elk Island National Park Christmas Bird Count, 1983 and 1984.

Species	1983	1984
Northern Goshawk		2
Ruffed Grouse	2	11
Rock Dove	42	3
Great Horned Owl	5	3
Snowy Owl		2
Downy Woodpecker	22	19
Hairy Woodpecker	13	11
Black-backed Woodpecker		1
Pileated Woodpecker	1	
Gray Jay		1
Blue Jay	38	51
Black-billed Magpie	155	66
Common Raven	1	
Black-capped Chickadee	275	365
Boreal Chickadee	1	3
White-breasted Nuthatch	2	5
Brown Creeper		2
Bohemian Waxwing	1	1
Northern Shrike	1	3
Dark-eyed Junco		1
Snow Bunting	240	230
Pine Grosbeak	26	15
Common Redpoll	100	
Hoary Redpoll	10	
Evening Grosbeak	108	168
House Sparrow	148	65

3.6 Spring/Fall Waterfowl Survey

Species observed during the spring and fall waterfowl surveys are grouped as follows: dabbling ducks, diving ducks, grebes, heron/cormorants, rails/shorebirds and American Coots. Spring was considered to be April and May and fall was considered to be August through October. Bird observations were related to wetland types as outlined by Kemper (1974). These wetland types describe wetlands by their size (large, intermediate, pothole), vegetation cover (open, closed) and origins (dugout, natural).

During the spring waterfowl surveys, 39 species were recorded in association with wetlands. The Canada Goose was the only goose observed. Mallards were the most abundant dabbling ducks while the Lesser Scaup dominated the diving ducks. There was proportionally more large wetlands in our sampling than there is in the park and, although the Red-necked Grebe reached higher densities than the Horned Grebe on intermediate and large open wetlands, the Horned Grebe is probably more common in the park. The American Coot was clearly the most abundant rail in the park and the Black Tern was the most abundant tern species.

Forty-eight species of birds were recorded in the fall waterfowl surveys. The Canada Goose was again the only goose recorded. The Mallard was also the dominant dabbling duck and the Lesser Scaup the dominant diving duck. The most abundant grebe in fall was the Horned Grebe. The American Coot occurred in numbers which surpassed all other rail species combined, and at many times and locations, coot numbers were higher than the numbers for any other bird species. Black Terns were the most abundant tern or gull species.

3.6.1 Spring wetland type use

No loons were recorded during the spring waterfwl surveys. Four species of grebes were found during the spring waterfowl surveys (Table 3.6.1.1, Figs. 3.6.1, 3.6.2, 3.6.3). The Pied-billed Grebe was not frequently recorded and was found only in intermediate closed and large closed wetlands. The Horned Grebe was the most widely distributed grebe in the park. It occurred in four wetland types and was most common in large closed wetlands. Red-necked Grebes were recorded in the same wetland types where Horned Grebes were found but occurred at highest densities in intermediate and large open wetlands. The importance of large open wetlands to this species is indicated also by the results of a 1982 Warden Service survey of Red-necked Grebes which found 112 active nests on Astotin Lake. Eared Grebes were not as common as Red-necked or Horned Grebes. They occurred in intermediate open wetlands and large closed wetlands and were most abundant in the large closed wetlands. Potholes were not used by grebes. As a group, grebes were most abundant in large wetlands in spring (Table 3.6.1.1).

Canada Geese were found in four wetland types in spring and occurred at highest densities in intermediate closed and dugout wetlands.

Dabbling ducks were found in all wetland types in spring. Potholes, however, clearly had the highest density of dabblers (Table 3.6.1.2, Figs. 3.6.4, 3.6.5, 3.6.6, 3.6.7). Green-winged and Blue-winged Teal were found in most wetland habitats but highest densities of both species were recorded in open potholes. Teal preferred closed over open wetlands (Table 3.6.1.1). Mallards were found in all wetland types.

Table 3.6.1.1. Densities (birds/100 ha) of birds in wetland types in Elk Island National Park, spring 1984.

	WETLAND TYPES						
		Pothole		Intermediate		Large	
	Dugout	Open	Closed	Open	Closed	Open	Closed
Pied-billed Grebe					1.72		.32
Horned Grebe	12.64			12.56		7.33	56.96
Red-necked Grebe	6.89			29.07		22.61	1.89
Eared Grebe				3.07		.71	8.86
Double-crested Cormorant						1.33	
Great Blue Heron						.44	
Canada Goose	19.54				22.41	.53	4.11
Green-winged Teal	12.64	194.44	35.77	7.69	22.41	2.30	33.22
Mallard	65.50	277.77	128.57	44.60	113.79	17.93	95.56
Northern Pintail	17.24				18.96	3.53	10.12
Blue-winged Teal	5.74	55.55	50.00		24.13	2.03	20.88
Northern Shoveler	4.59				22.41	3.09	25.94
Gadwall	8.04	55.55	114.28	1.53	18.96	.71	8.54
American Wigeon	19.50	250.00	428.57	12.30	168.96	4.14	26.00
Canvasback				3.07	25.86	6.80	7.59
Redhead	35.63			3.07	10.34	11.30	24.36
Ring-necked Duck	17.24		64.28	10.76	24.13	3.62	1.26
Lesser Scaup	144.80			6.15	13.79	68.47	229.11
Surf Scoter						.09	
White-winged Scoter							.26
Common Goldeneye	22.98			26.15	3.44	2.20	5.38
Bufflehead	33.33		14.28	7.69	8.62	4.00	6.64
Ruddy Duck						6.36	33.86
Northern Harrier						.09	
Sora	1.14				1.72	.09	
American Coot	124.13					167.69	366.13
Killdeer					5.17	.44	.32
Lesser Yellowlegs	1.14					.71	3.61
Solitary Sandpiper			7.14			.27	.63
Spotted Sandpiper	9.19		7.14			.09	.32
Common Snipe	1.14					.18	
Wilson's Phalarope							3.61
Franklin's Gull						17.20	24.68
Bonaparte's/Franklin's Gull							9.49
Ring-billed Gull						1.06	22.15
California/Ring-billed Gull							1.26
Common Tern						.62	
Black Tern						.44	
Gull sp.						.09	
Eastern Kingbird							.32
Yellow-headed Blackbird							1.26

Figure 3.6.1. Density of grebe species in dugout wetlands during the spring waterfowl surveys.

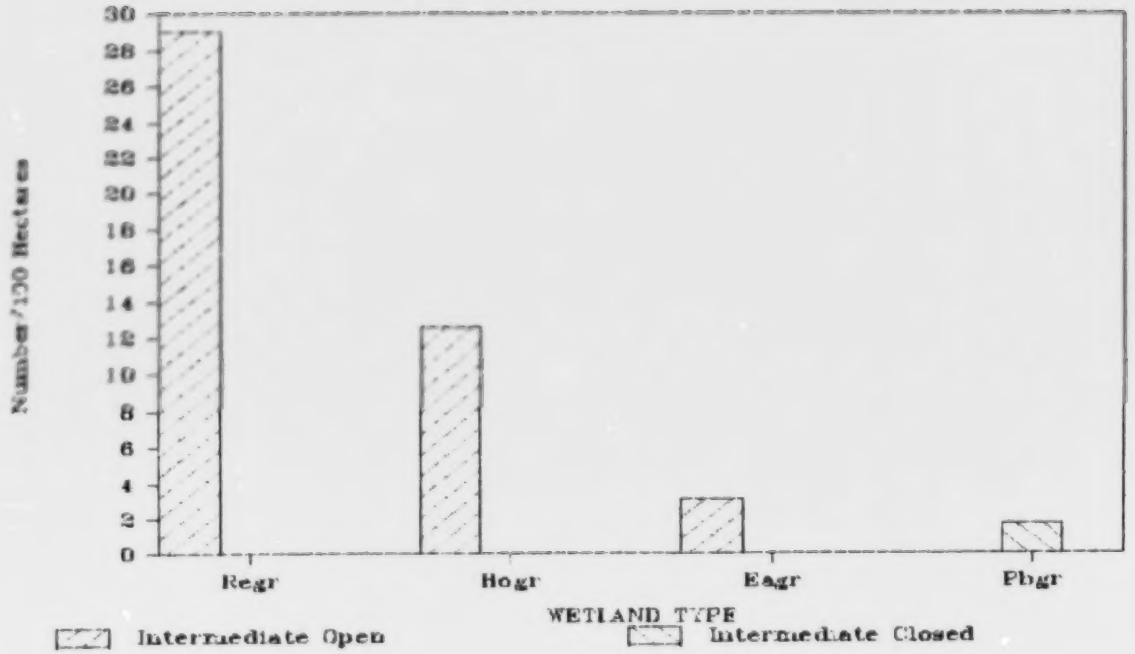

Figure 3.6.2. Density of grebe species in intermediate wetlands during the spring waterfowl surveys.

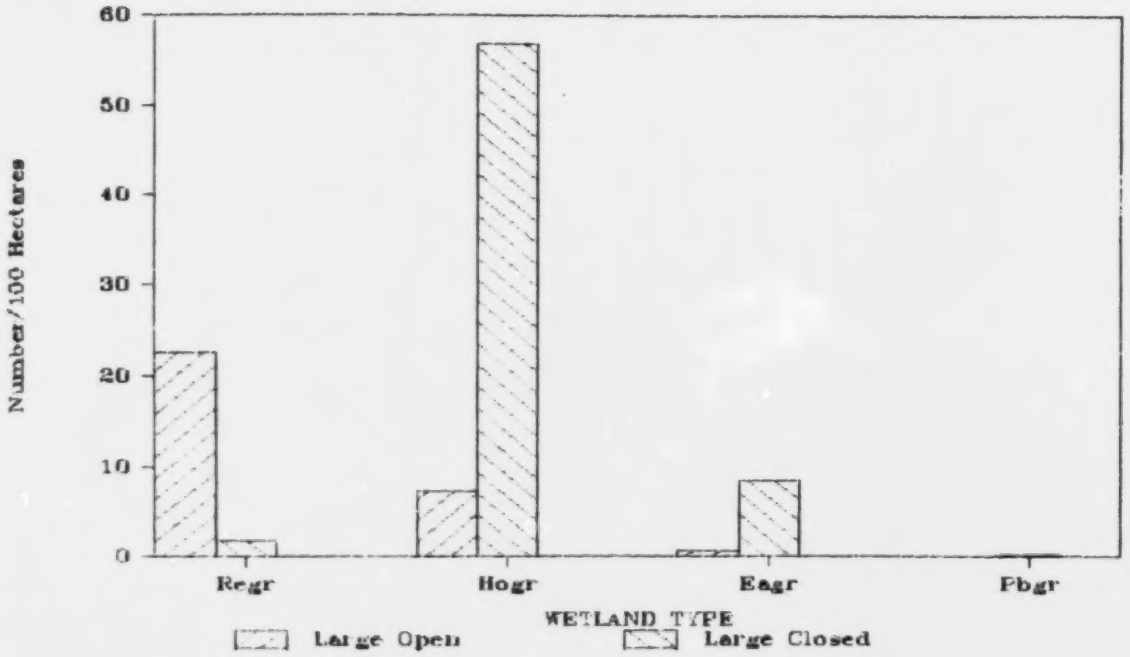

Figure 3.6.3. Density of grebe species in large wetlands during the spring waterfowl surveys.

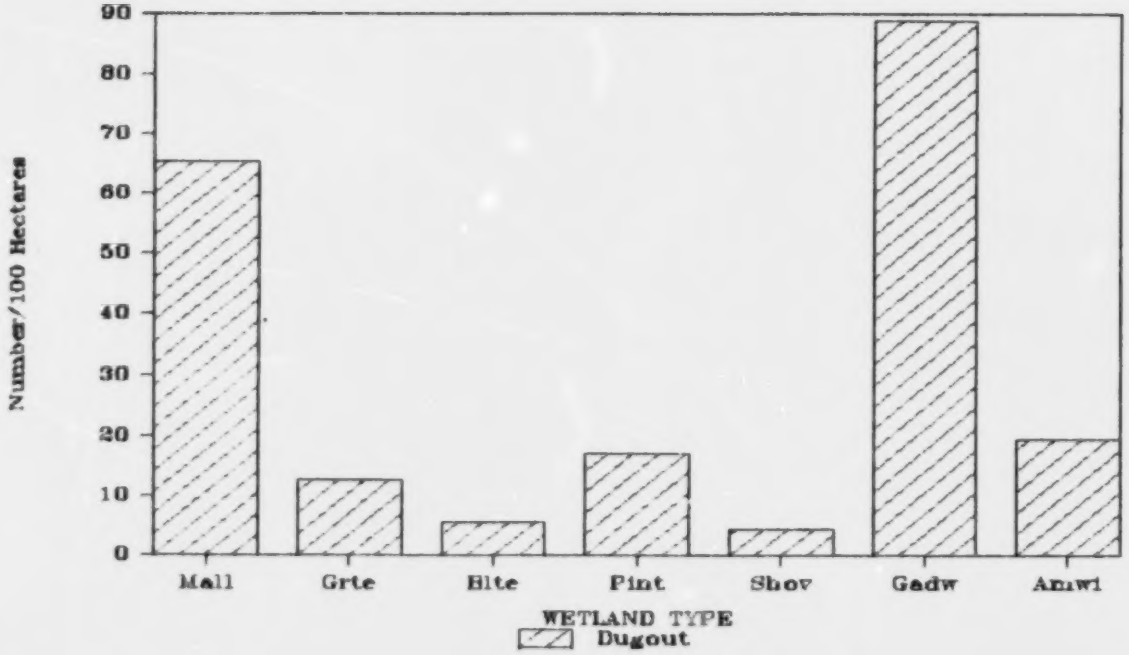

Figure 3.6.4. Density of dabbling duck species in dugout wetlands during the spring waterfowl surveys.

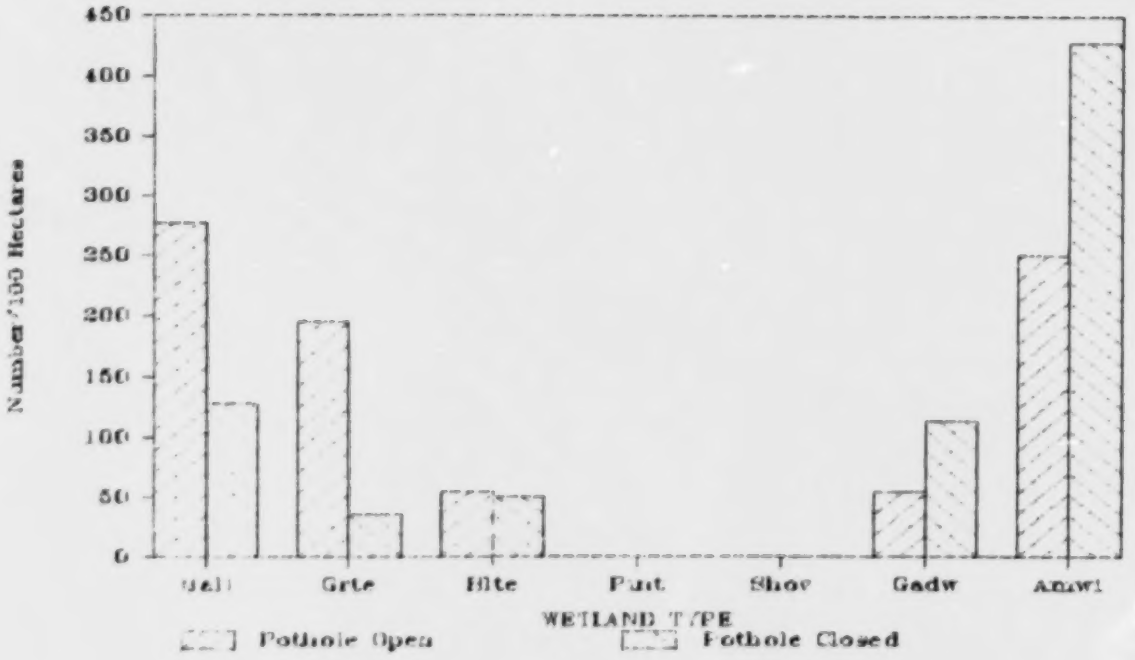

Figure 3.6.5. Density of dabbling duck species in pothole wetlands during the spring waterfowl surveys.

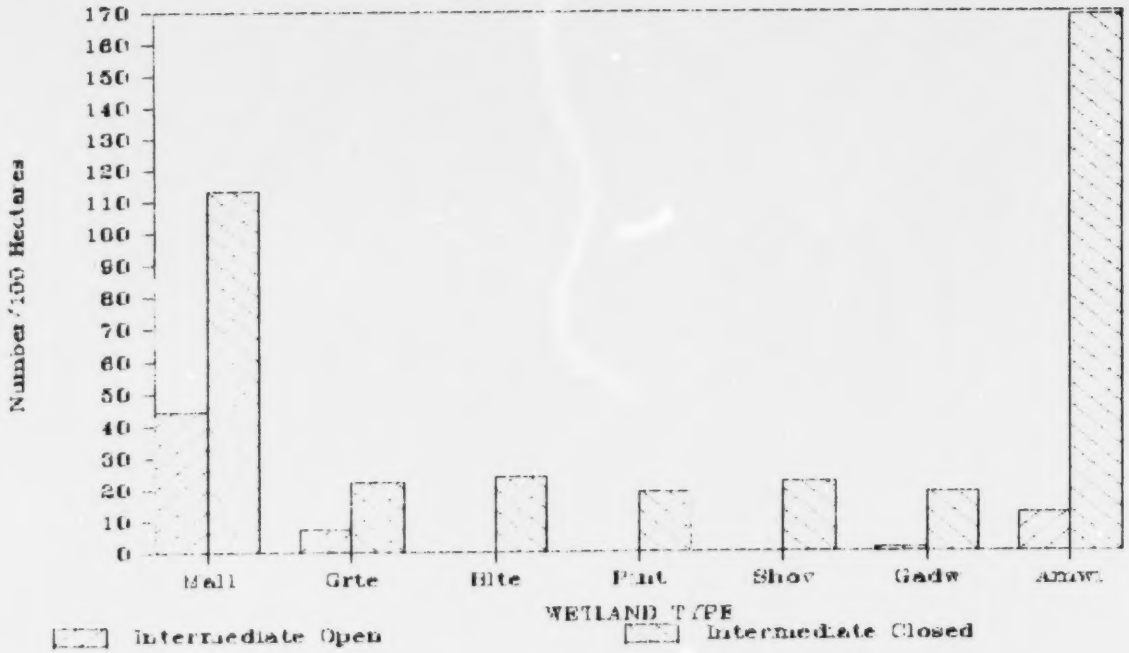

Figure 3.6.6. Density of dabbling duck species in intermediate wetlands during the spring waterfowl surveys.

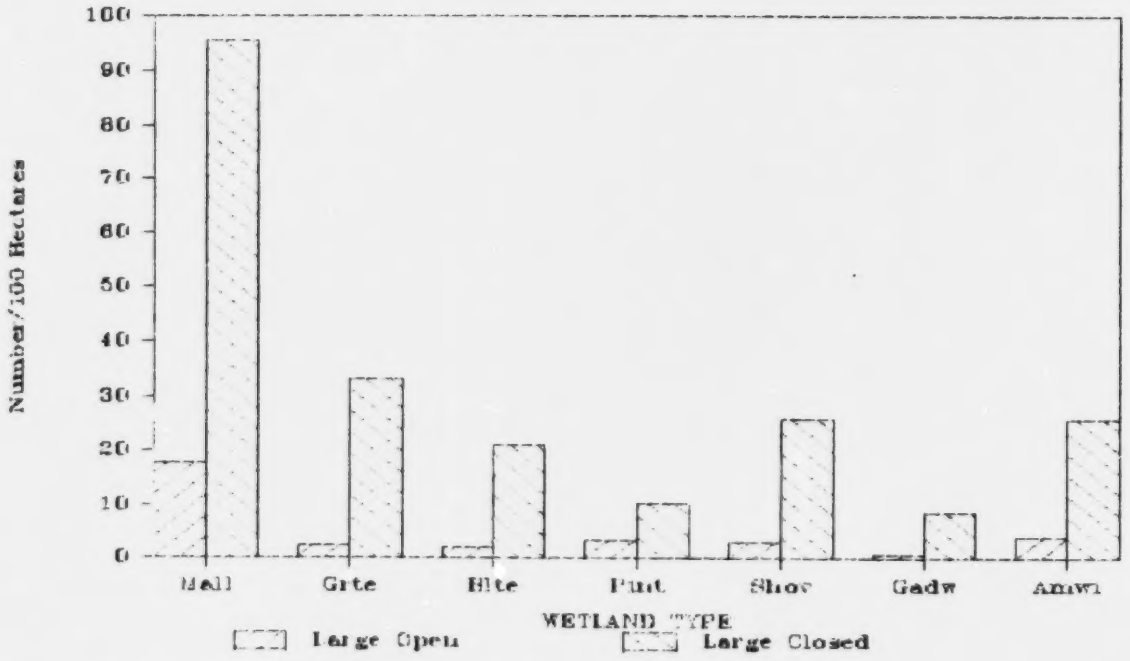

Figure 3.6.7. Density of dabbling duck species in large wetlands during the spring waterfowl surveys.

Open potholes had the highest density of Mallards but high numbers were also observed in intermediate and large closed wetlands. Pintails were not common in the park. The highest densities of Pintails were recorded in intermediate closed and dugout wetlands. Shovelers were observed at their highest densities in large and intermediate closed wetlands. Both the Gadwall and American Wigeon were recorded in all wetland types. They both were found at highest densities in potholes and at higher densities in closed rather than open wetlands.

Diving ducks, as a group, appeared to prefer large wetlands in spring (Table 3.6.1.2, Figs. 3.6.8, 3.6.9, 3.6.10, 3.6.11). This preference is attributable to the habitat preference and high numbers of one species, the Lesser Scaup. Scaup appeared in highest densities in large closed wetlands and at just over half that density in dugouts (Table 3.6.1.1). Ruddy Ducks occurred in their highest densities in large closed wetlands. Redheads occurred in highest densities in dugouts and next highest densities in large closed wetlands. Bufflehead also were found at highest densities in dugouts. Highest densities of Ring-necked Ducks were observed in closed potholes. Both intermediate open wetlands and dugouts had high densities of the Common Goldeneye. Spring distribution of diving ducks suggests that most prefer closed rather than open wetlands.

The American Coot was recorded on only three wetland types (dug-outs, large open and large closed) (Fig. 3.6.12). Coots were either the most or second most abundant species in these wetlands. The highest coot densities were in large open wetlands.

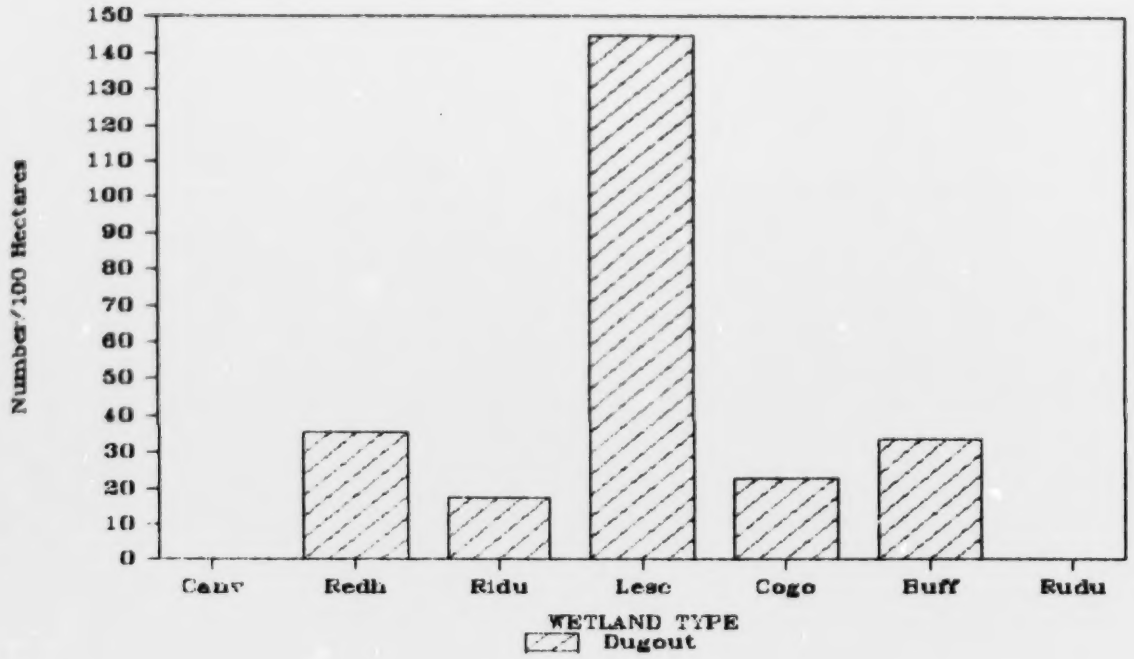

Figure 3.6.8. Density of diving duck species in dugout wetlands during the spring waterfowl surveys.

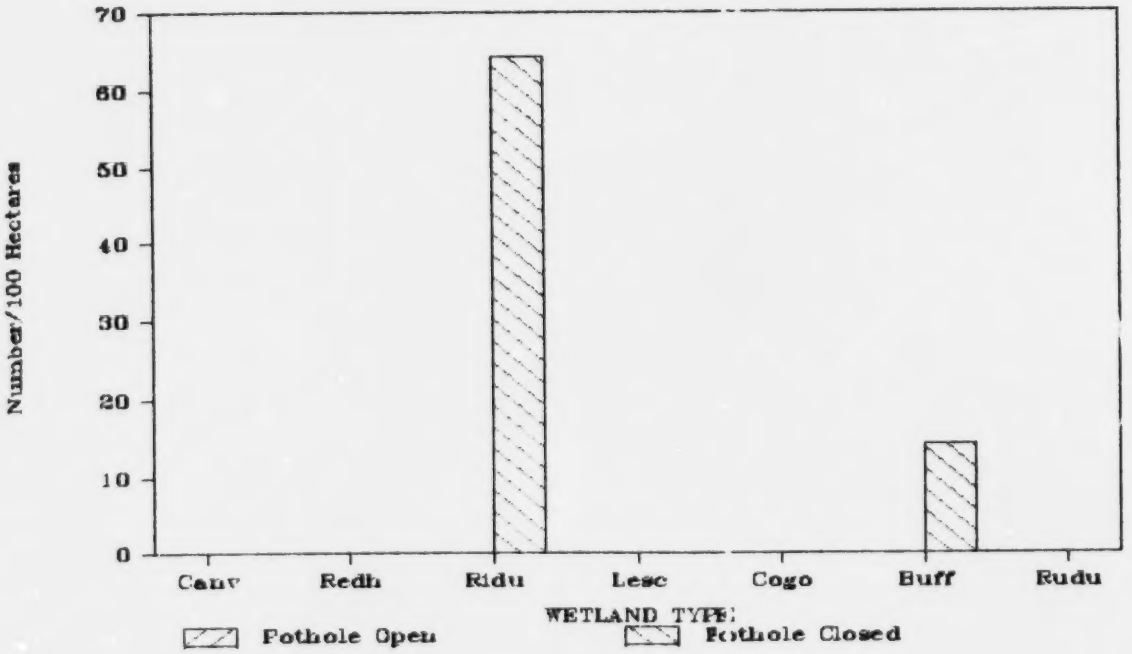

Figure 3.6.9. Density of diving duck species in pothole wetlands during the spring waterfowl surveys.

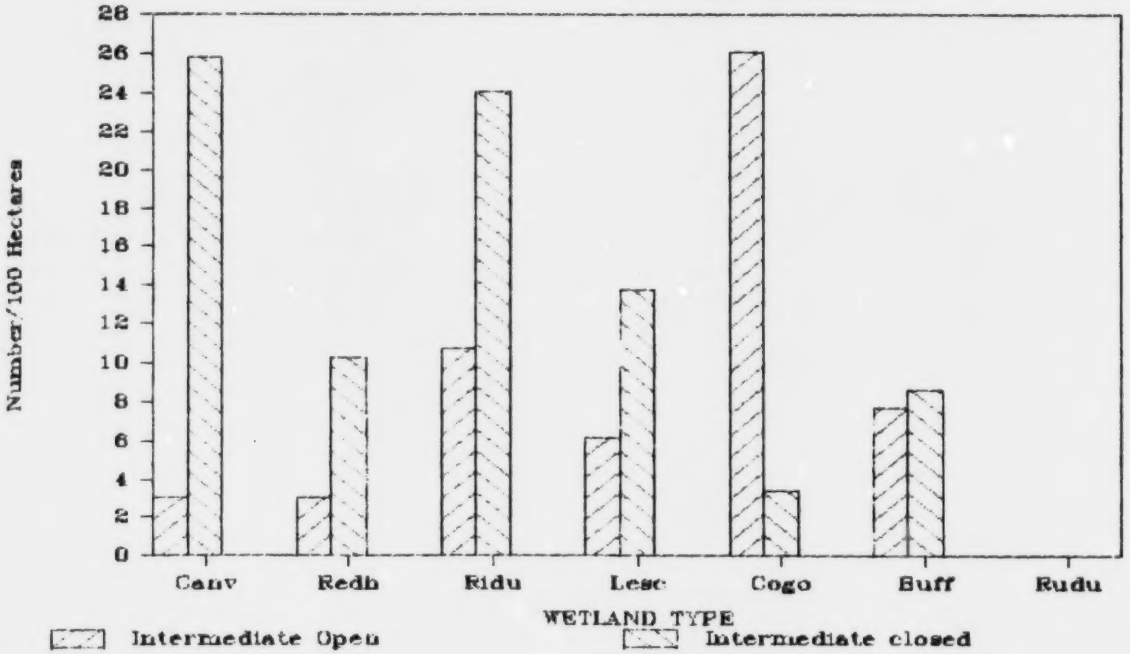

Figure 3.6.10. Density of diving duck species in intermediate wetlands during the spring waterfowl surveys.

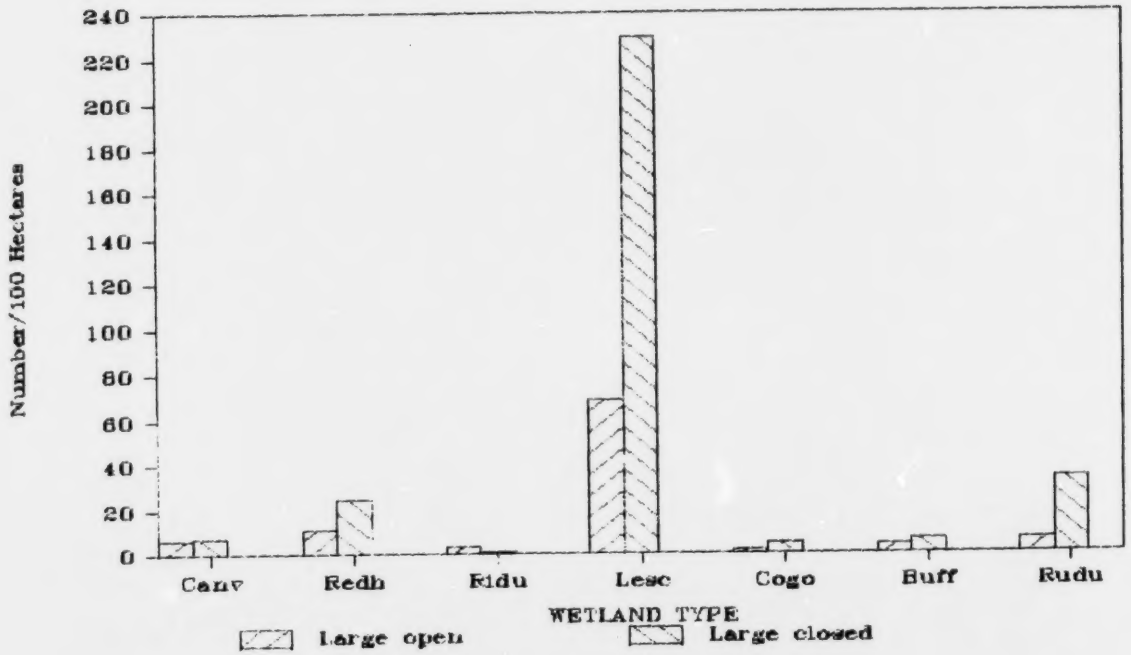

Figure 3.6.11. Density of diving duck species in large wetlands during the spring waterfowl surveys.

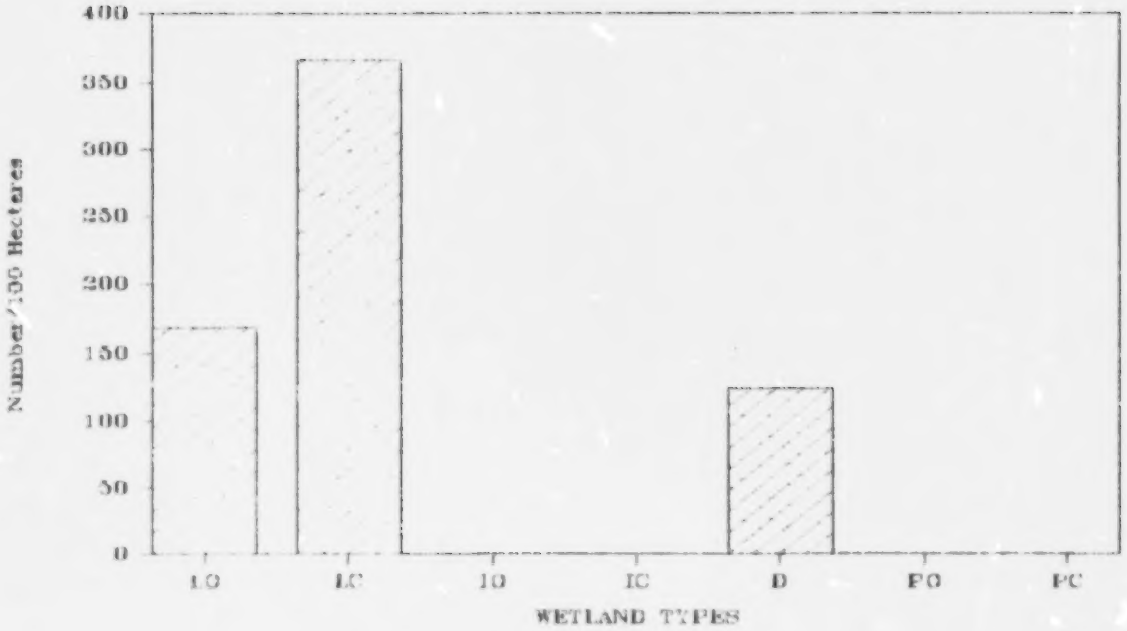

Figure 3.6.12. Density of the American Coot in seven wetland types during the spring waterfowl surveys.

Shorebirds were recorded in very low numbers in comparison with waterfowl numbers. The Killdeer appeared to be most abundant around intermediate closed wetlands, Lesser Yellowlegs were most common around large closed wetlands, Solitary Sandpipers were most common around closed potholes, and Spotted Sandpipers and Common Snipes were common at the edges of dugouts (Table 3.6.1.1., Figs. 3.6.13, 3.6.14, 3.6.15, 3.6.16.)

Gulls and terns were found only around large wetlands in spring. Closed wetlands generally had higher densities of gulls and terns than open wetlands (Table 3.6.1.1.).

The Great Blue Heron, Black-crowned Night Heron and Double-crested Cormorant were found only in large open wetlands in spring (Fig. 3.6.17).

3.6.2. Fall wetland type use

The Common Loon was recorded recorded only in large open wetlands during the fall waterfowl surveys (Table 3.6.2.1).

Grebes occurred mostly in large wetlands and dugouts in fall (Table 3.6.2.2, Figs. 3.6.18, 3.6.19, 3.6.20). Both Eared Grebes and Horned Grebes were found at their highest densities in dugouts. All observations of Red-necked Grebes in fall came from large open wetlands. Pied-billed Grebes were recorded only a few times and these records came from intermediate open and large closed wetlands. Western Grebes showed up in the fall surveys in intermediate open and large open wetlands.

The Canada Goose appeared only in large open wetlands in fall and in relatively low densities (Table 3.6.2.1).

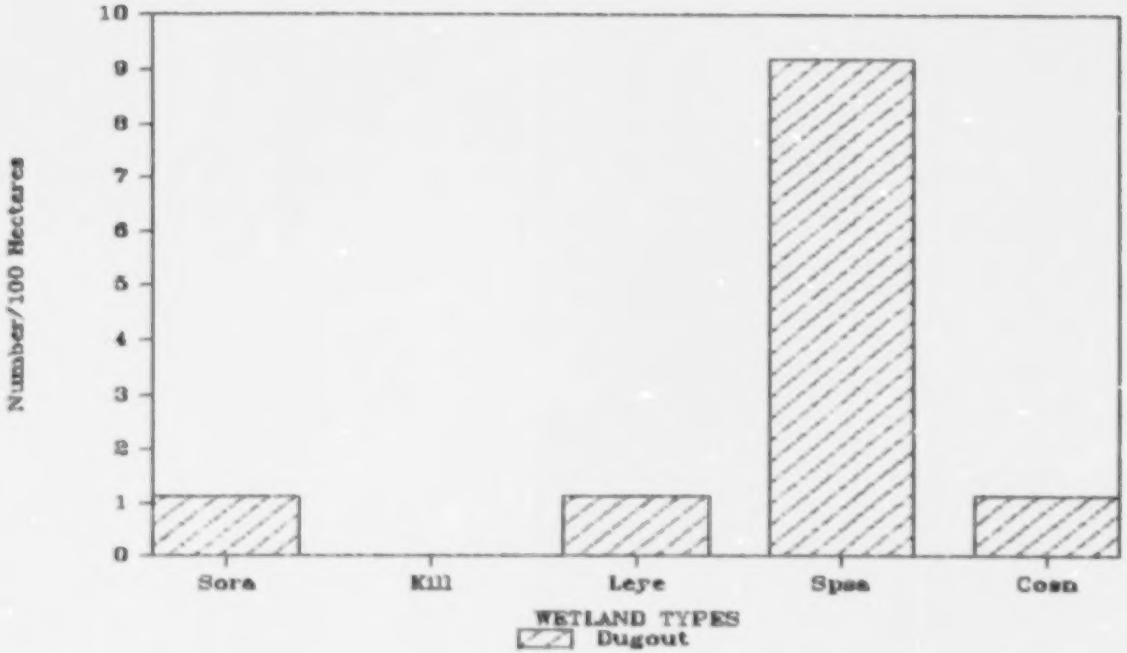

Figure 3.6.13. Density of the Sora and shorebird species in dugout wetlands during the spring waterfowl surveys.

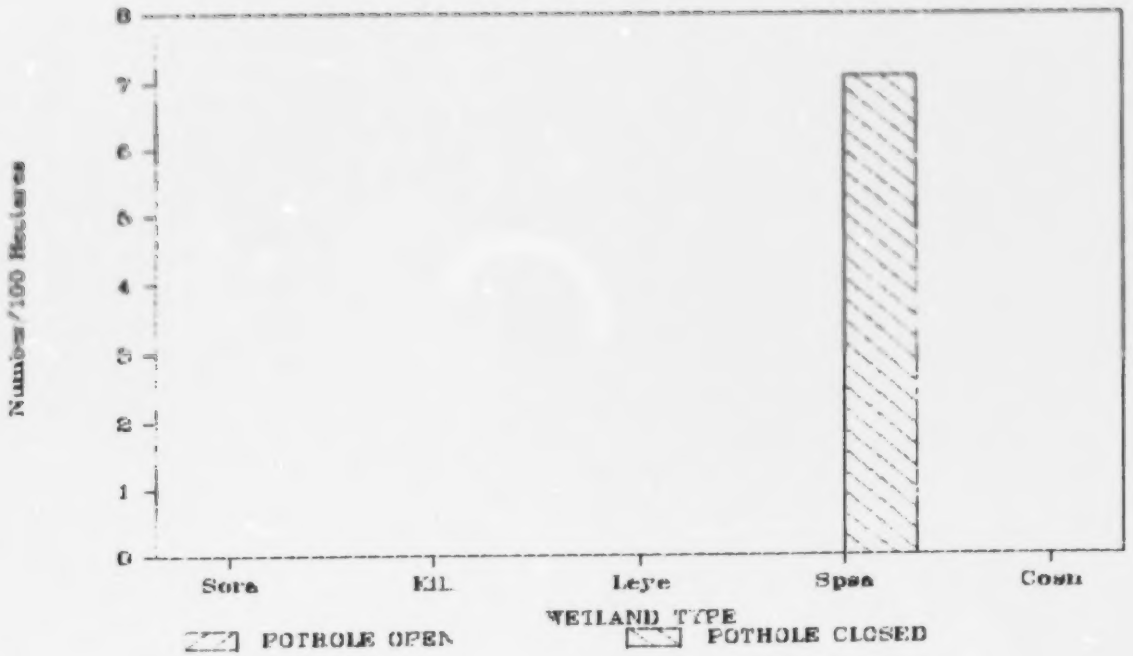

Figure 3.6.14. Density of the Sora and shorebird species in pothole wetlands during the spring waterfowl surveys.

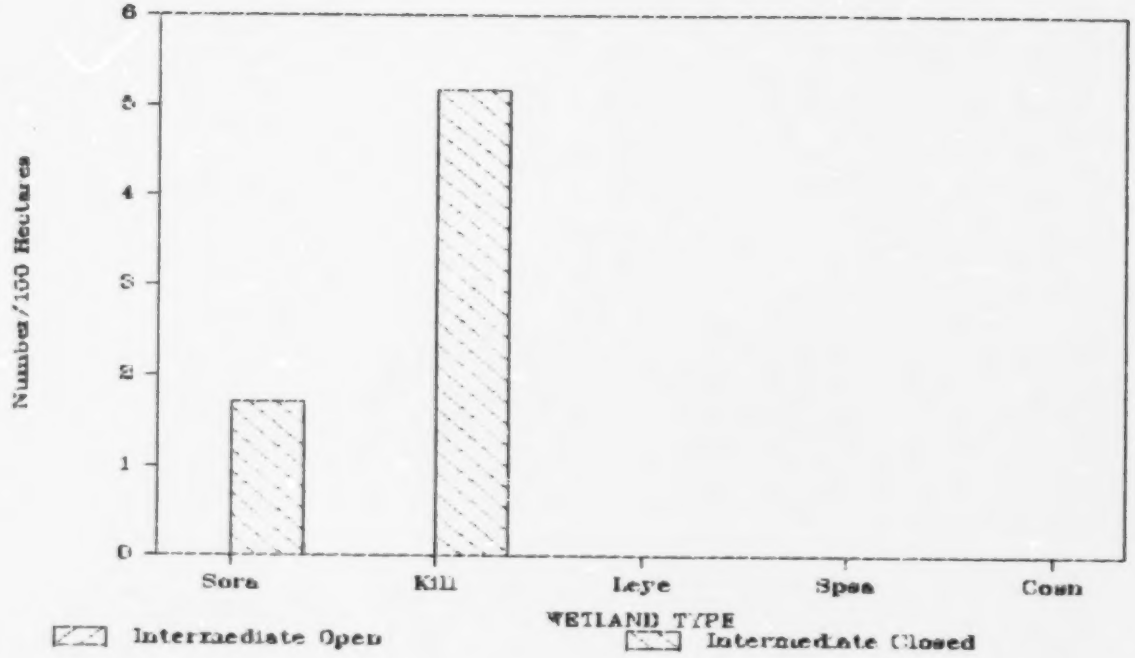

Figure 3.6.15. Density of the Sora and shorebird species in intermediate wetlands during the spring waterfowl surveys.

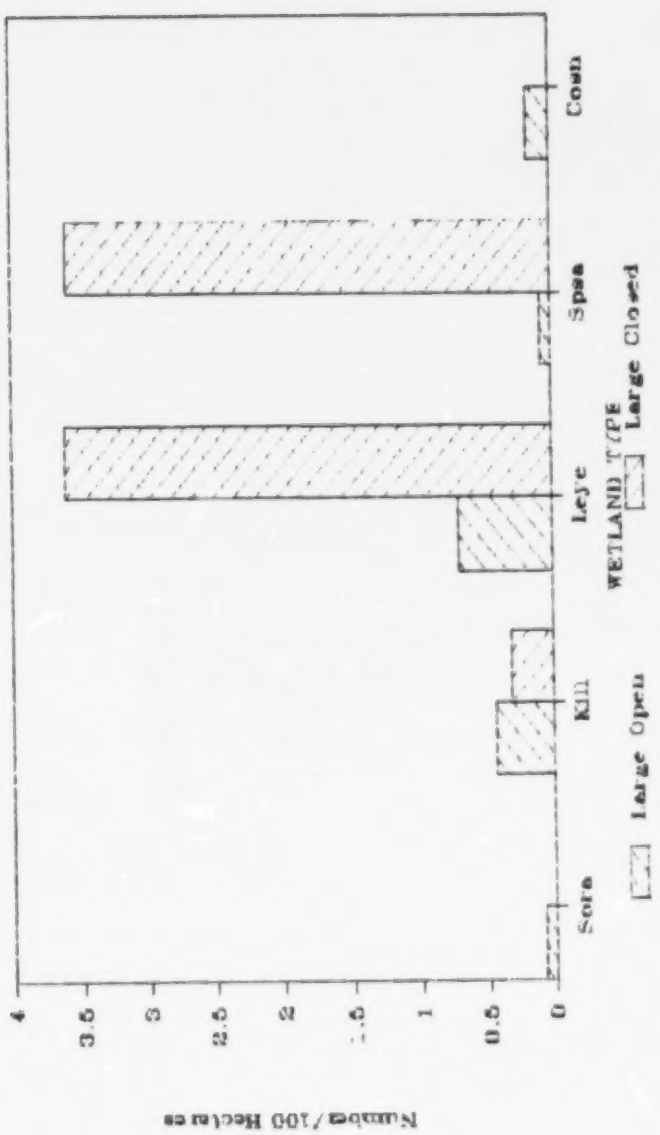

Figure 3.6.16. Density of the Sora and shorebird species in large wetlands during the spring waterfowl surveys.

Figure 3.6.17. Density of herons and cormorants in large wetlands during the spring waterfowl surveys.

Table 3.6.2.1. Densities (birds/100 ha) of birds in wetland types in Elk Island National Park, fall 1984.

	WETLAND TYPES						
		Pothole		Intermediate		Large	
	Dugout	Open	Closed	Open	Closed	Open	Closed
Common Loon						.10	
Pied-billed Grebe				1.02			.19
Horned Grebe	8.82			.51		3.04	
Red-necked Grebe						3.74	
Eared Grebe	5.88			1.02		.40	
Western Grebe				.51		.71	
Double-crested Cormorant						4.25	
Great Blue Heron			16.29			.20	
Canada Goose						.30	
Green-winged Teal	5.88		32.58	2.03		1.21	.19
Mallard	52.90	1691.47	545.70	73.24	90.87	128.74	16.61
Blue-winged Teal		1691.47	187.33	37.64	74.35	27.63	9.16
Northern Shoveler				3.05		3.44	.38
Gadwall					11.01	8.50	
American Wigeon				54.42	11.01	22.27	
Dabbling Duck spp.			65.16	26.45	2.75	2.73	3.24
Canvasback						1.62	
Redhead				.51		5.26	
Lesser Scaup	5.88	2083.69		139.37	66.09	155.87	.57
Common Goldeneye	17.63			4.07		6.78	
Barrow's Goldeneye						.71	
Bufflehead	17.63	171.60		42.22	13.77	10.63	1.15
Ruddy Duck				1.02		19.64	1.53
Diving Duck spp.						2.02	
Duck spp.				21.36	8.26	253.64	4.77
Red-tailed Hawk		24.51		.51	2.75	.10	
Sora				.51		1.92	
American Coot		4535.09	24.43	10.17	209.27	857.36	18.71
Spotted Sandpiper			16.29				.76
Ring-billed Gull						4.25	
Bonaparte's Gull						.81	
Common Tern						.10	
Black Tern		196.11					
Mourning Dove				.51			
Hairy Woodpecker							.19
Least Flycatcher		24.51					.19
Eastern Kingbird		98.06		2.03			1.15
Tree Swallow		49.03					
Bank Swallow						12.15	
Barn Swallow						5.06	
American Crow							.19
Black-capped Chickadee			24.43	3.56	2.75		.76
Cedar Waxwing							.95
Red-eyed Vireo							.38
Chipping Sparrow							.19
Song Sparrow					2.75		
White-throated Sparrow						.10	.19
Red-winged Blackbird				.51			
Yellow-headed Blackbird				1.02			

Table 3.6.1.2. Density (per 100 ha) of birds (by taxonomic groups) in four wetland types during the spring 1984 waterfowl surveys.

	WETLAND TYPE			
	Dugout	Pothole	Intermediate	Large
Grebes	19.5		46.5	98.6
Herons & Cormorants				1.7
Dabbling Ducks	133.5	1590.5	455.5	254.0
Diving Ducks	253.9	78.6	143.5	410.5
American Coot	124.1			533.8
Shorebirds	19.5	14.3	6.9	17.1

Table 3.6.2.2. Density (per 100 ha) of birds (by taxonomic groups) in four wetland types during the fall 1984 waterfowl surveys.

	WETLAND TYPE			
	Dugout	Pothole	Intermediate	Large
Grebes	14.8		2.6	7.4
Herons & Cormorants		16.3		4.4
Dabbling Ducks	59.0	42173.0	386.7	224.1
Diving Ducks	41.1	2255.3	267.2	203.2
American Coot		4779.5	219.5	876.1
Shorebirds		65.3	3.3	2.7
Unidentified ducks			29.6	258.4

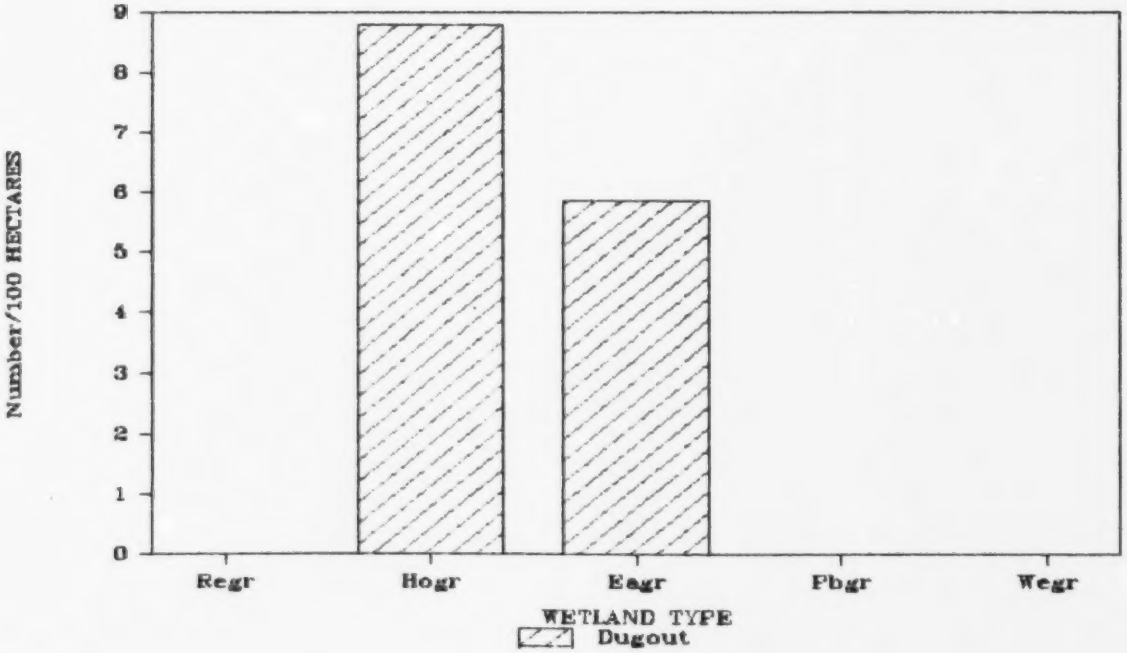

Figure 3.6.18. Density of grebe species in dugout wetlands during the fall waterfowl surveys.

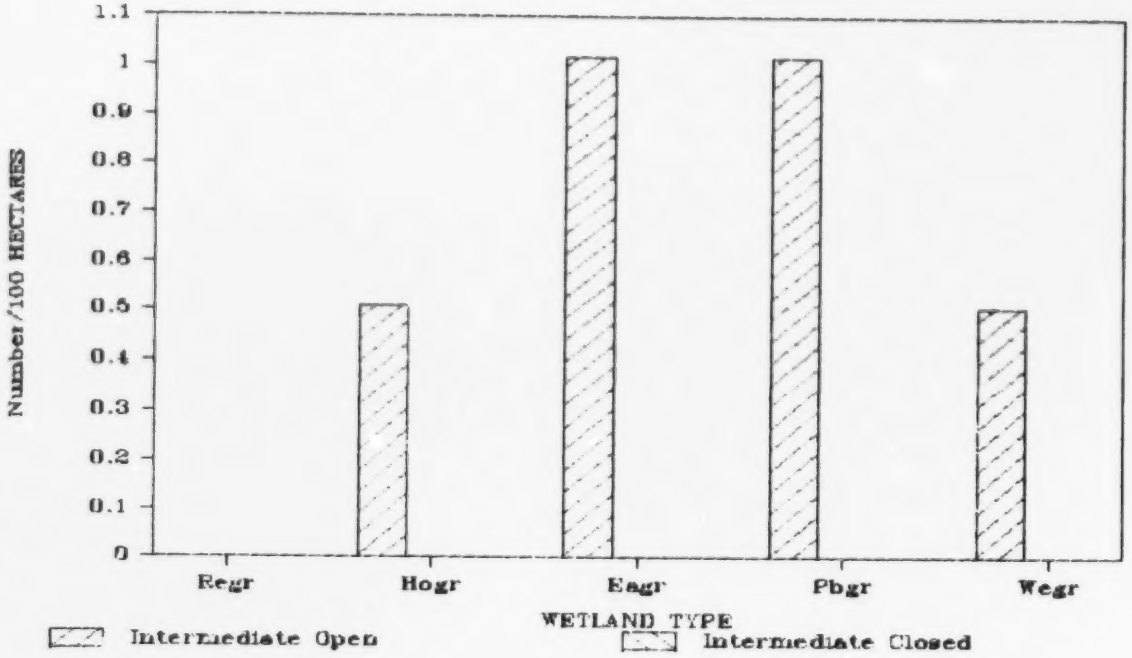

Figure 3.6.19. Density of grebe species in intermediate wetlands during the fall waterfowl surveys.

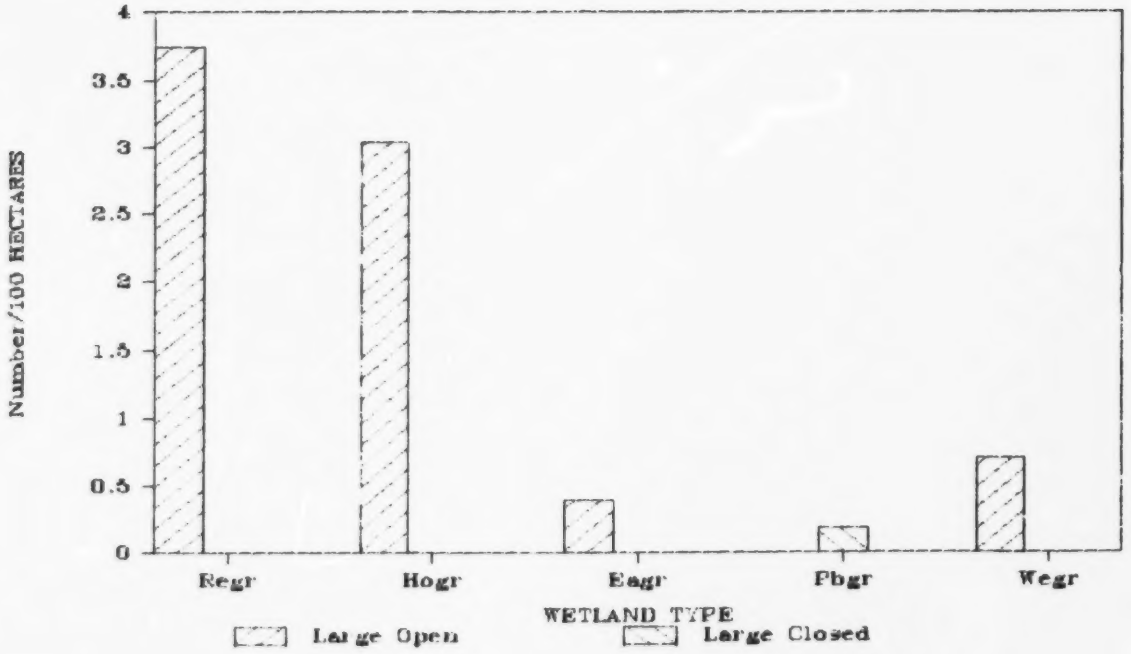

Figure 3.6.20. Density of grebe species in large wetlands during the fall waterfowl surveys.

Dabbling ducks were abundant in potholes in fall and their density in dugouts was relatively low (Table 3.6.2.2, Figs. 3.6.21, 3.6.22, 3.6.23, 3.6.24, 3.6.25). Highest densities of Mallards and Blue-winged Teal were recorded in potholes, particularly in open potholes (Table 3.6.2.1). Green-winged Teal were most abundant in closed potholes. Pintails were not recorded in the fall surveys. Shoveler and Gadwall records were not common. All Gadwalls were observed in intermediate closed and large open wetlands. The majority of Shoveler records come from intermediate open and large open wetlands. American Wigeon were found in highest densities in intermediate open wetlands but were also found in intermediate closed and large open wetlands.

Diving ducks shifted their highest densities from large wetlands toward potholes in fall (Table 3.6.2.2, Figs. 3.6.26, 3.6.27, 3.6.28, 3.6.29, 3.6.30, 3.6.31). The Lesser Scaup, the most abundant species of diving duck in the park, was largely responsible for the high density of divers in potholes in fall. The density of Scaup in open potholes was more than ten times that in any other wetland type. Buffleheads were also found in their highest densities in open potholes. The Common Goldeneye was the only diver observed at peak densities in dugouts. Barrow's Goldeneye was observed in large open wetlands in fall. (The sudden appearance of Barrow's Goldeneye may be because of a sudden influx of late migrants, or may indicate that observers incorrectly identified the birds as the similar-looking Common Goldeneye during earlier surveys.) Highest fall densities of Canvasbacks, Redheads, and Ruddy Ducks were found in large open wetlands. Ring-necked Ducks were not recorded in fall waterfowl surveys.

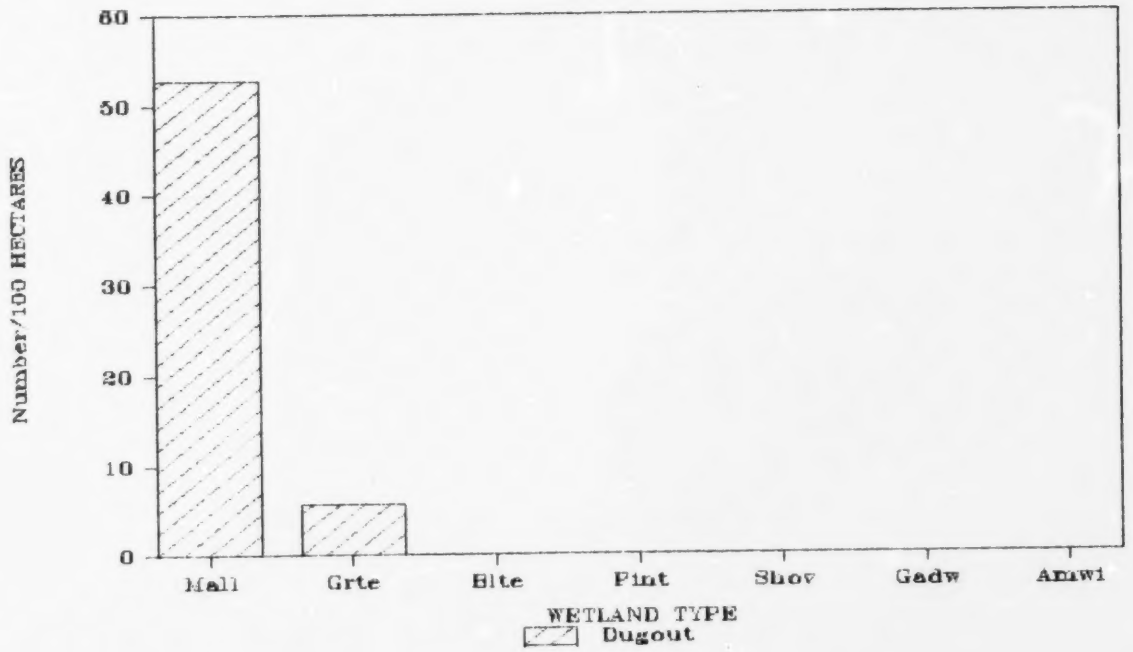

Figure 3.6.21. Density of dabbling duck species in dugout wetlands during the fall waterfowl surveys.

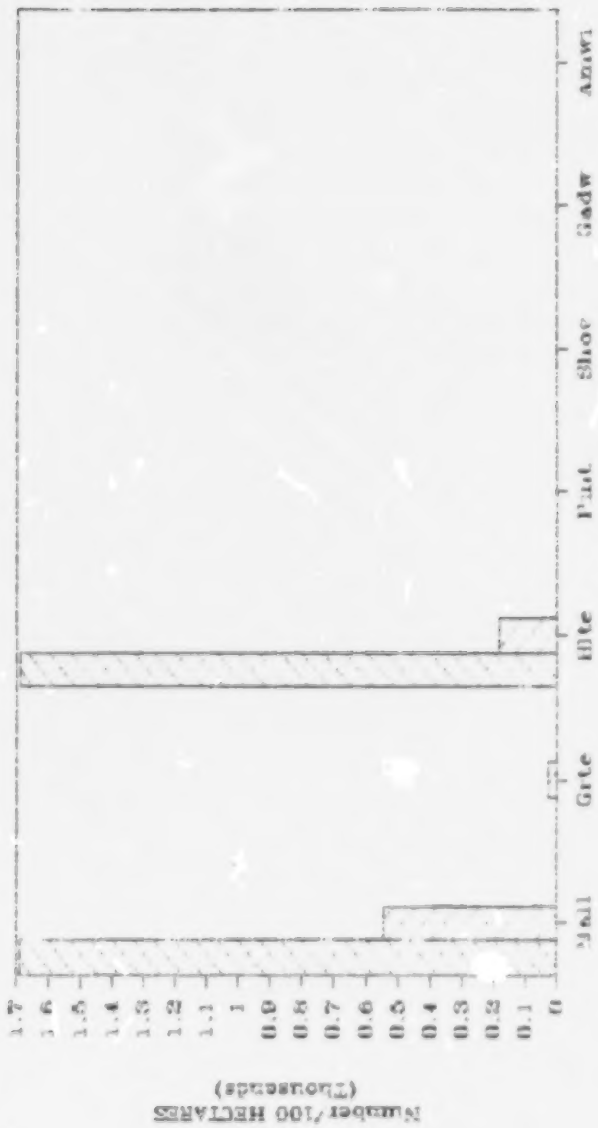

Figure 3.6.22 Density of dabbling duck species in pothole wetlands during the fall waterfowl surveys.

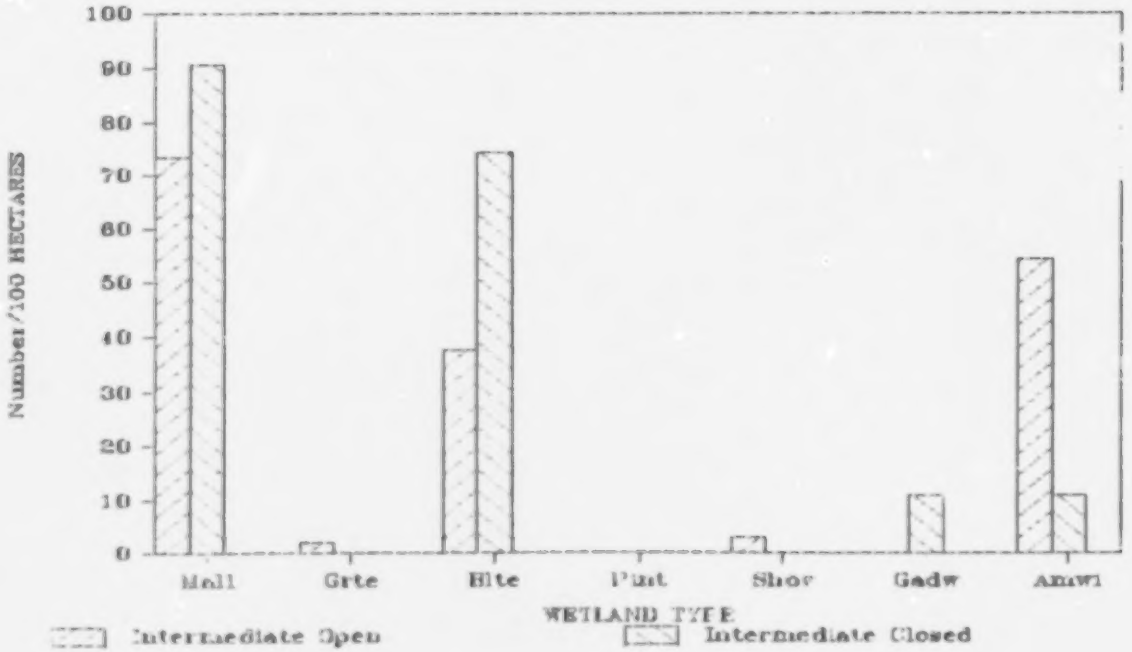

Figure 3.6.23. Density of dabbling ducks in intermediate wetlands during the fall waterfowl surveys.

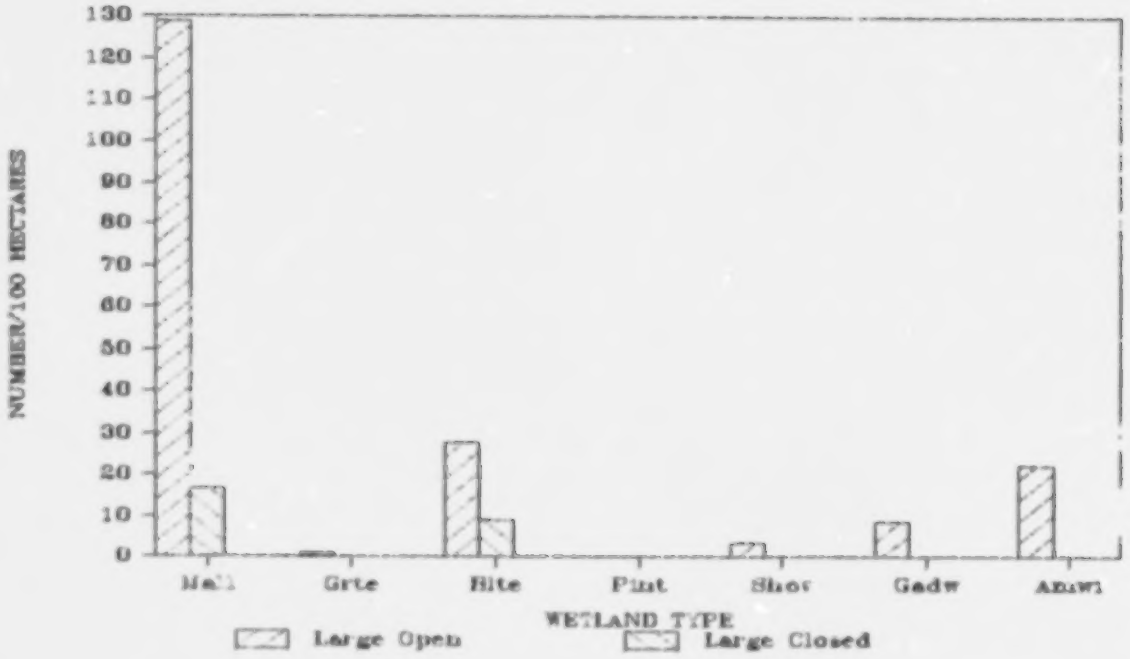

Figure 3.6.24. Density of dabbling duck species in large wetlands during the fall waterfowl survey.

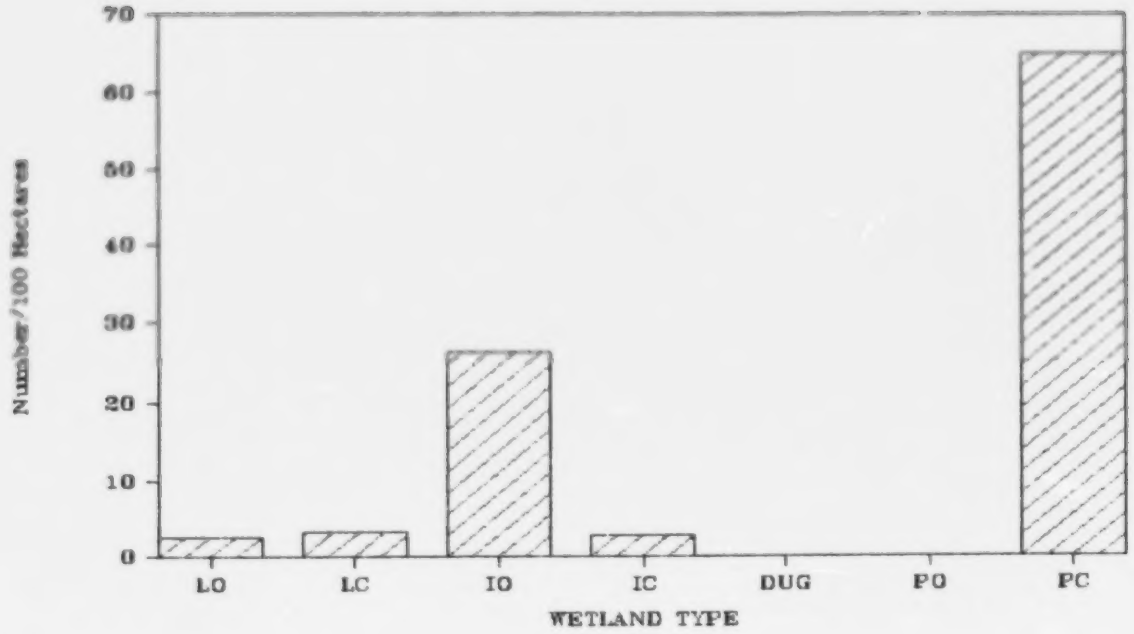

Figure 3.6.25. Density of unidentified dabbling ducks in seven wetland types during the fall waterfowl survey.

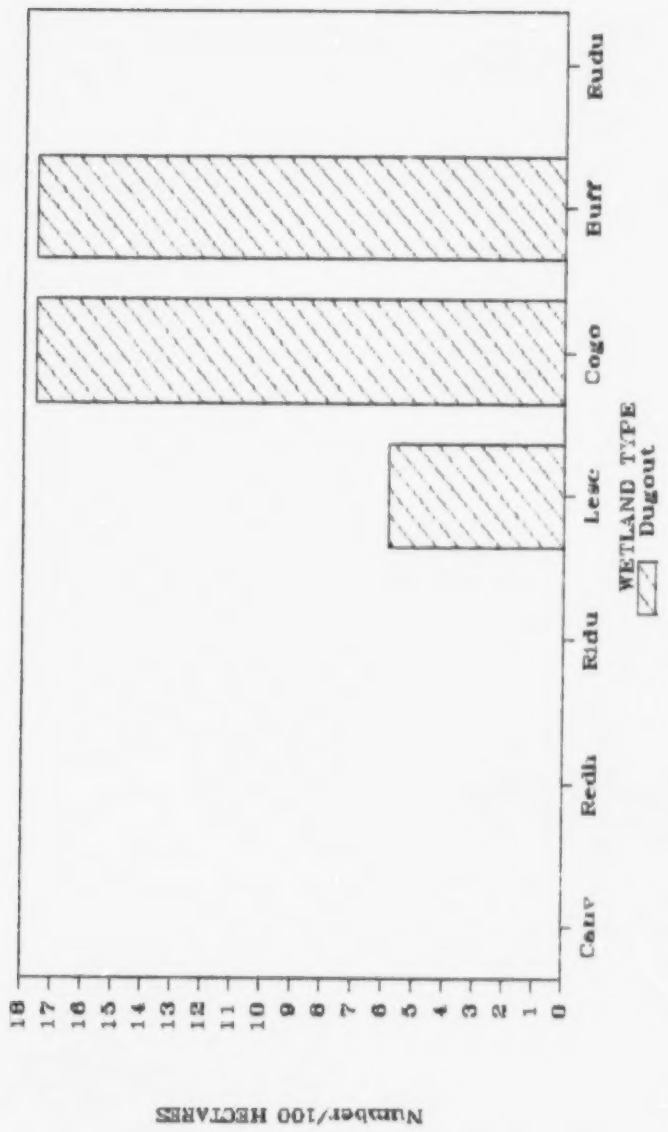

Figure 3.6.26. Density of diving duck species in dugout wetlands during the fall waterfowl surveys.

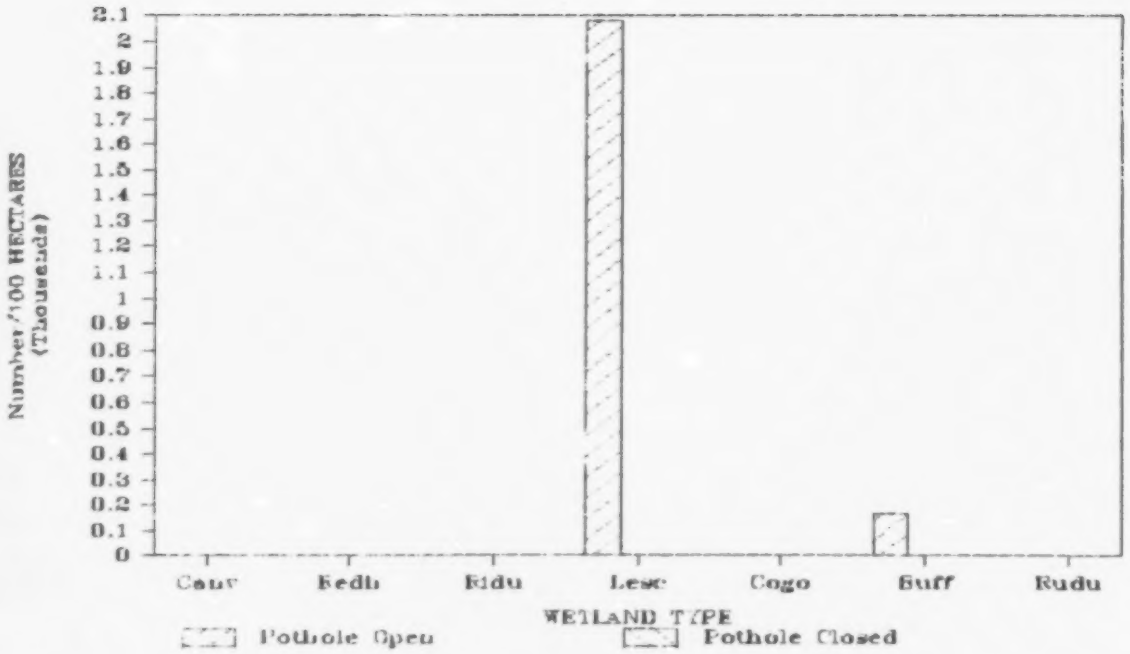

Figure 3.6.27. Density of diving duck species in pothole wetlands during the fall waterfowl surveys.

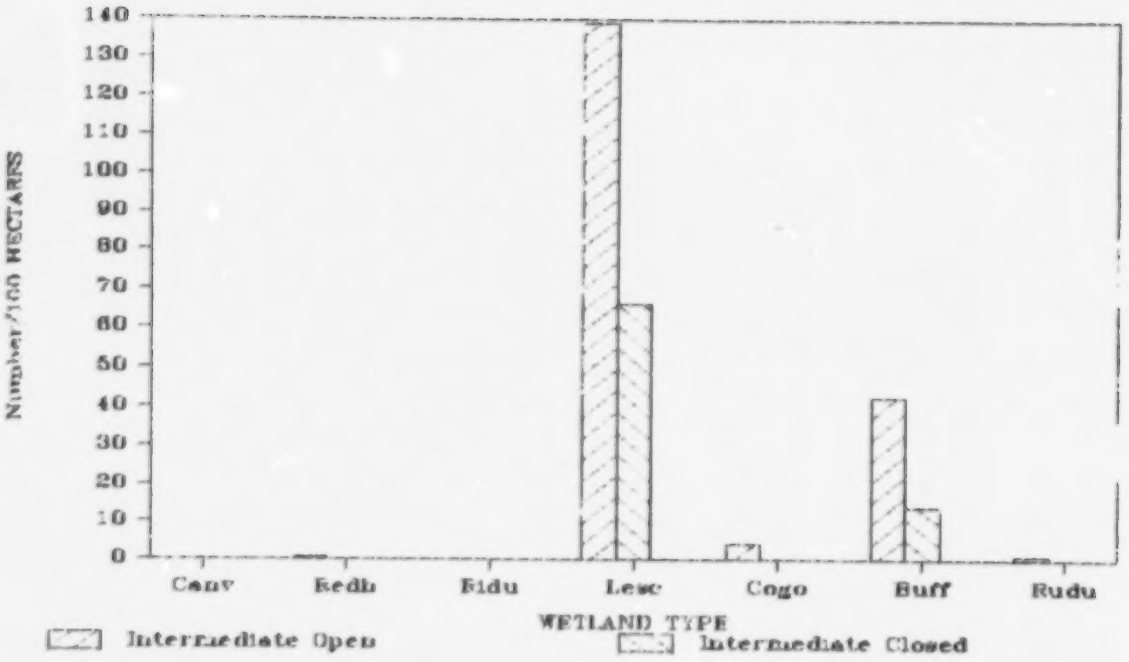

Figure 3.6.28. Density of diving duck species in intermediate wetlands during the fall waterfowl surveys.

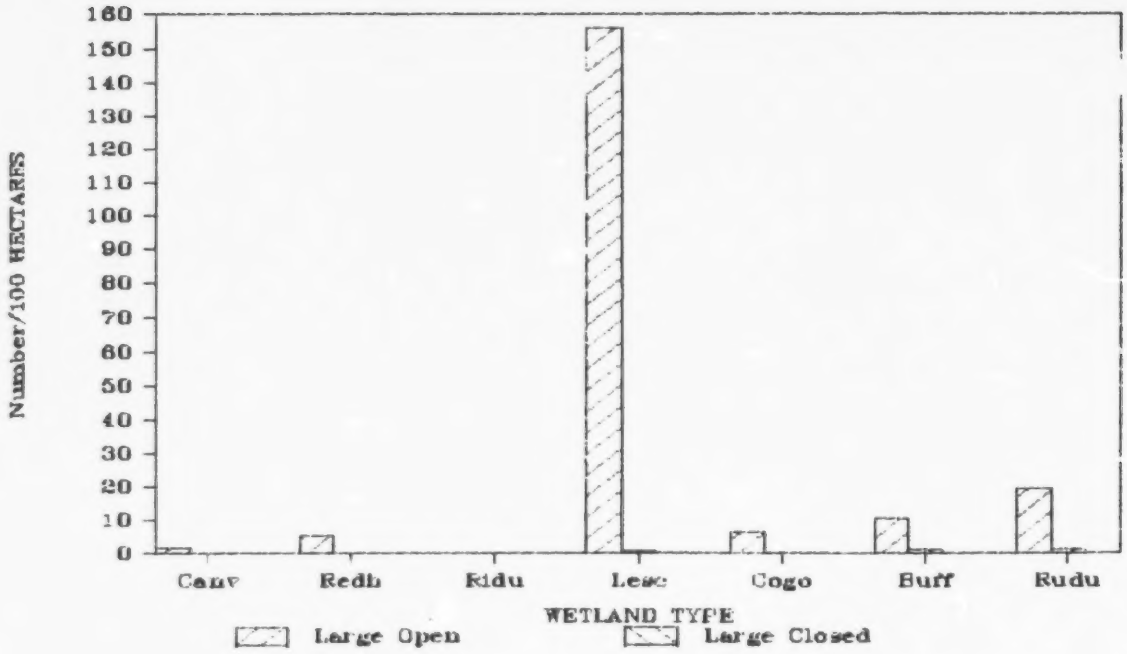

Figure 3.6.29. Density of diving duck species in large wetlands during the fall waterfowl surveys.

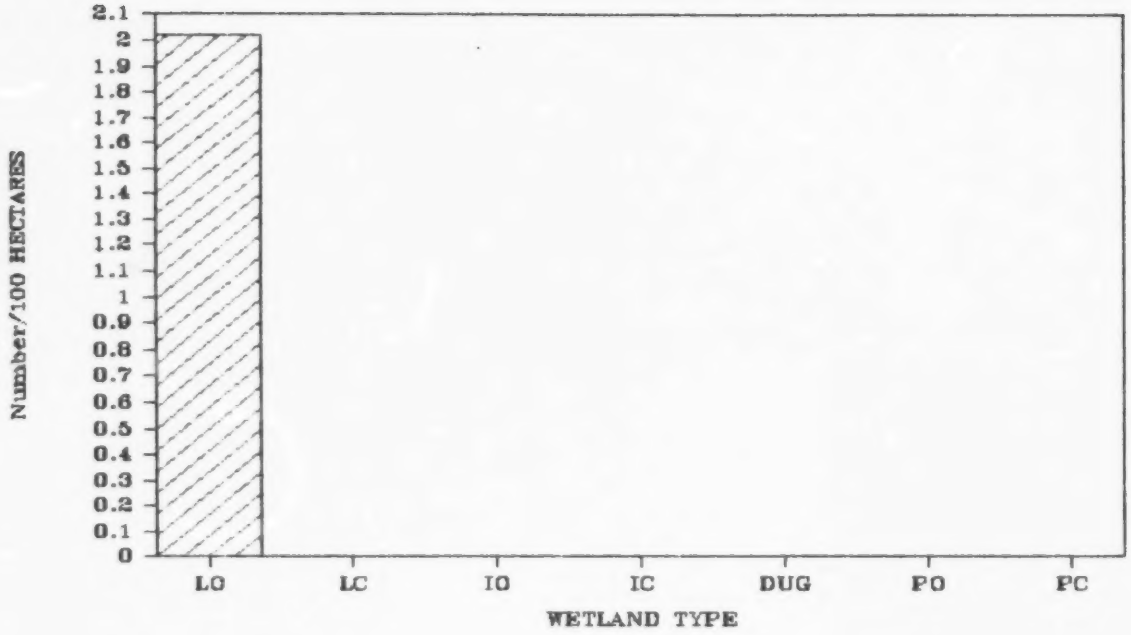

Figure 3.6.30. Density of unidentified diving ducks in seven wetlands during the fall waterfowl surveys.

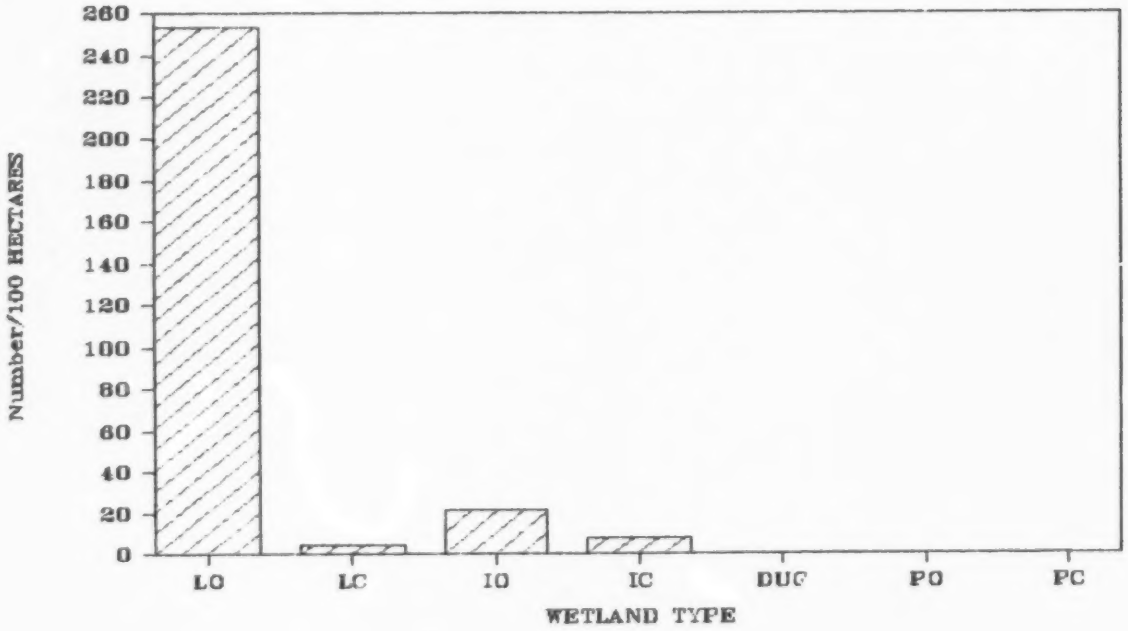

Figure 3.6.31. Density of unidentified ducks in seven wetland types during the fall waterfowl surveys.

The American Coot, like the Lesser Scaup, was most abundant in open potholes in fall. High coot densities were also found in large open wetlands (Table 3.6.2.1, Fig. 3.6.32).

Shorebirds, represented only by the Spotted Sandpiper in the fall surveys, were most abundant in closed potholes (Figs. 3.6.33, 3.6.34).

The gulls (Ring-billed and Bonaparte's) and the Common Tern were found only around large open wetlands. The Black Tern was only observed around open potholes.

In fall, the cormorants and the night herons were still found only in large open wetlands but the Great Blue Heron was also found in open potholes (Figs. 3.6.35, 3.6.36).

3.7 Summer Wetland Survey

In five wetlands visited during the summer wetland survey, the Mallard, Blue-winged Teal and Lesser Scaup were the common ducks and these species occurred at four out of the five wetlands (Table 3.7.1). American Wigeon and Bufflehead were recorded at three wetlands. Shorebirds, although not common, were represented by three species - Killdeer, Spotted Sandpiper and Common Snipe. Tree Swallows were observed at four wetlands and probably used these areas for nesting as well as feeding. Red-winged Blackbirds were common and were found at all surveyed wetlands. The largest wetland (#9) had the highest number of species among the five wetlands. These species included the Horned Grebe, Ring-necked Duck and California Gull which were not observed on the other survey wetlands. Ducklings of Mallards, Canvasbacks, Lesser Scaup and Buffleheads were observed in these wetlands.

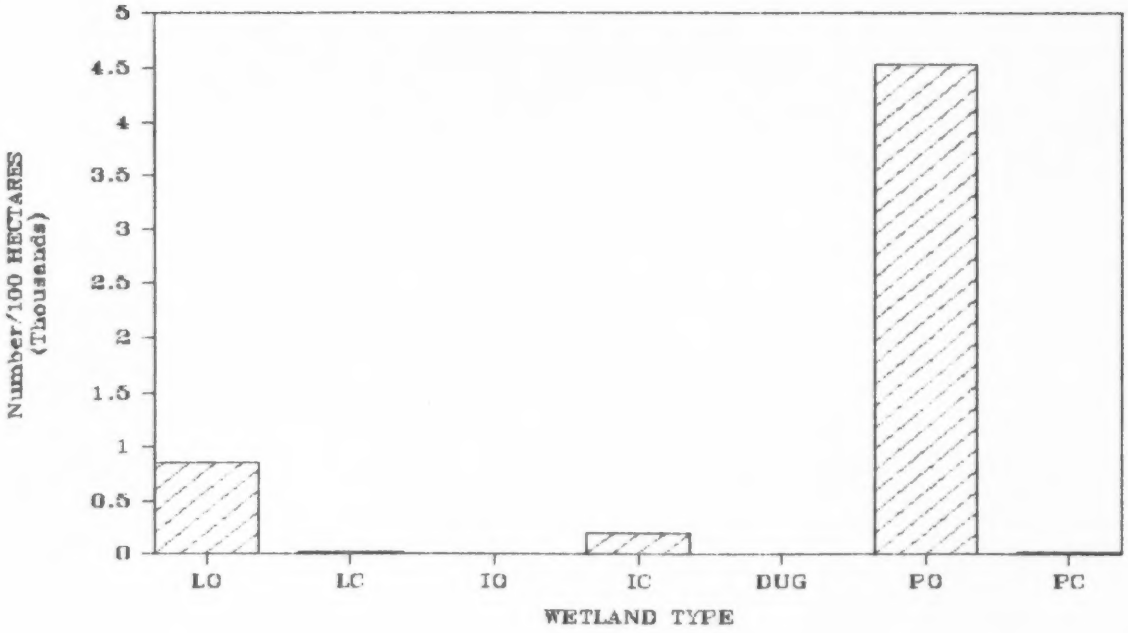

Figure 3.6.32. Density of the American Coot in seven wetland types during the fall waterfowl surveys.

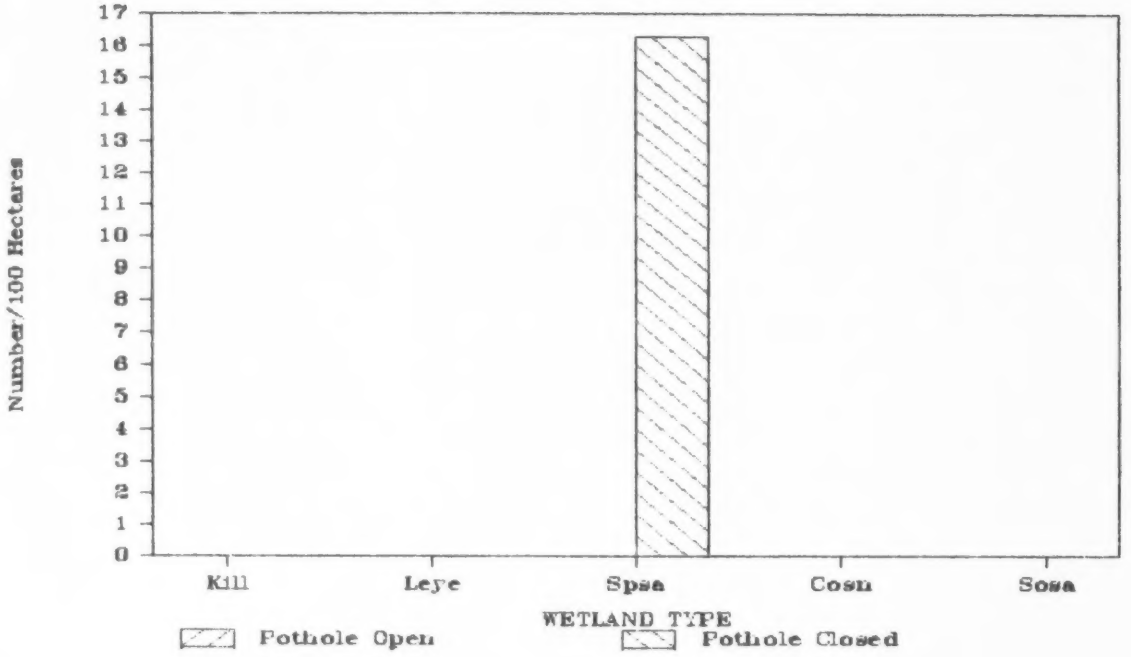

Figure 3.6.33. Density of shorebird species in pothole wetlands during the fall waterfowl surveys.

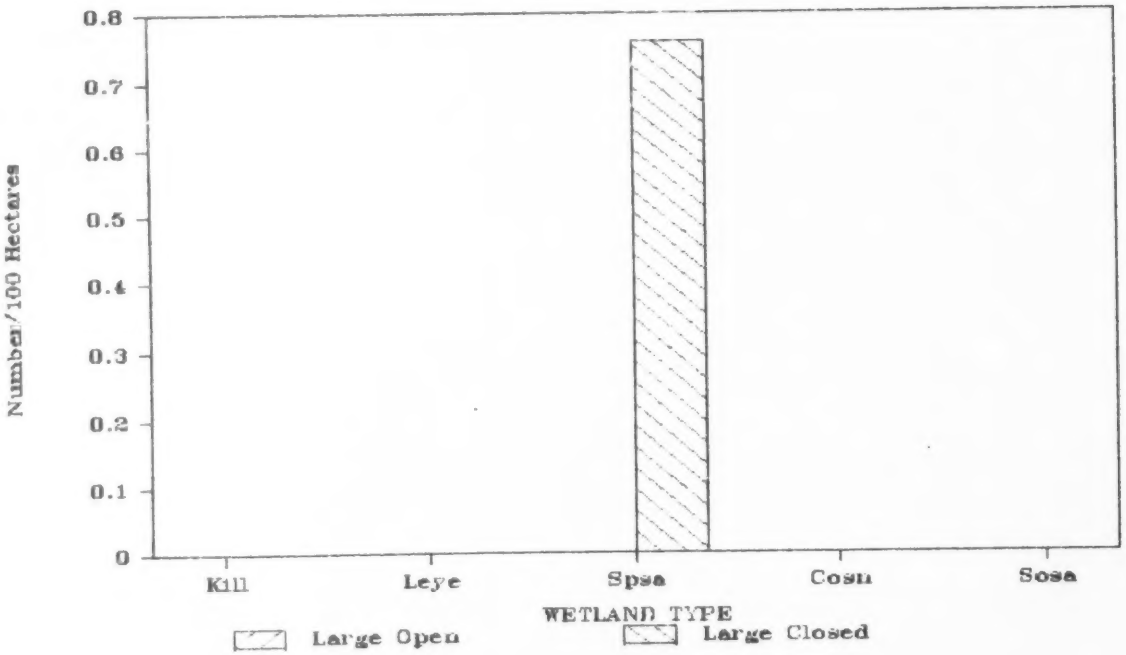

Figure 3.6.34. Density of shorebird species in large wetlands during the fall waterfowl surveys.

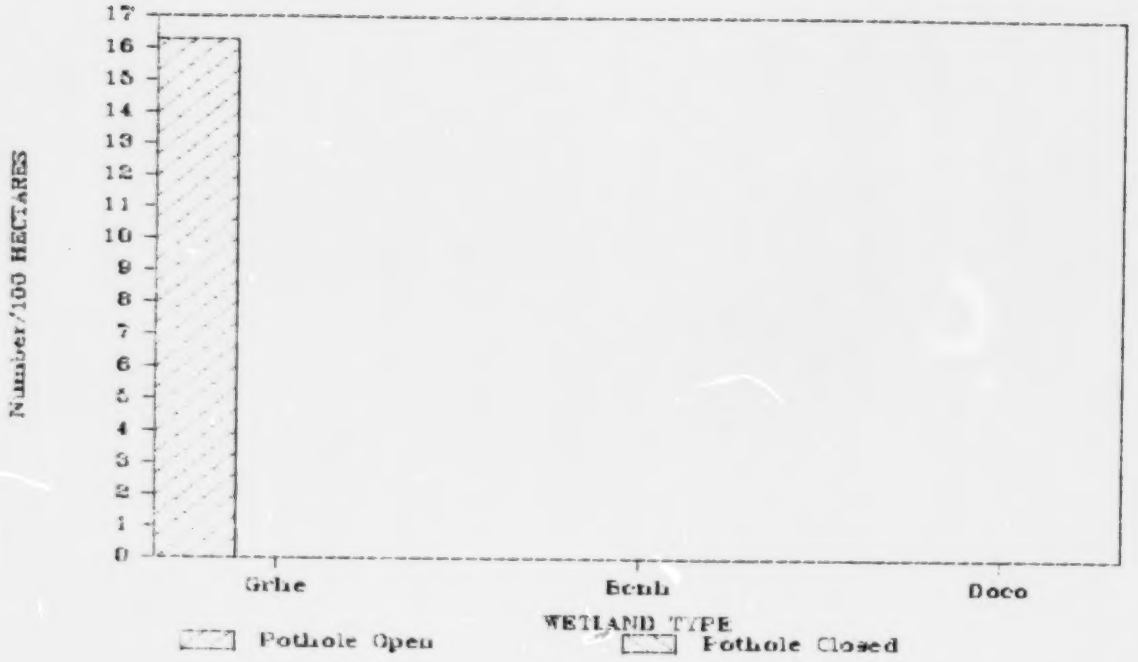

Figure 3.6.35. Density of herons and cormorants in pothole wetlands during the fall waterfowl surveys.

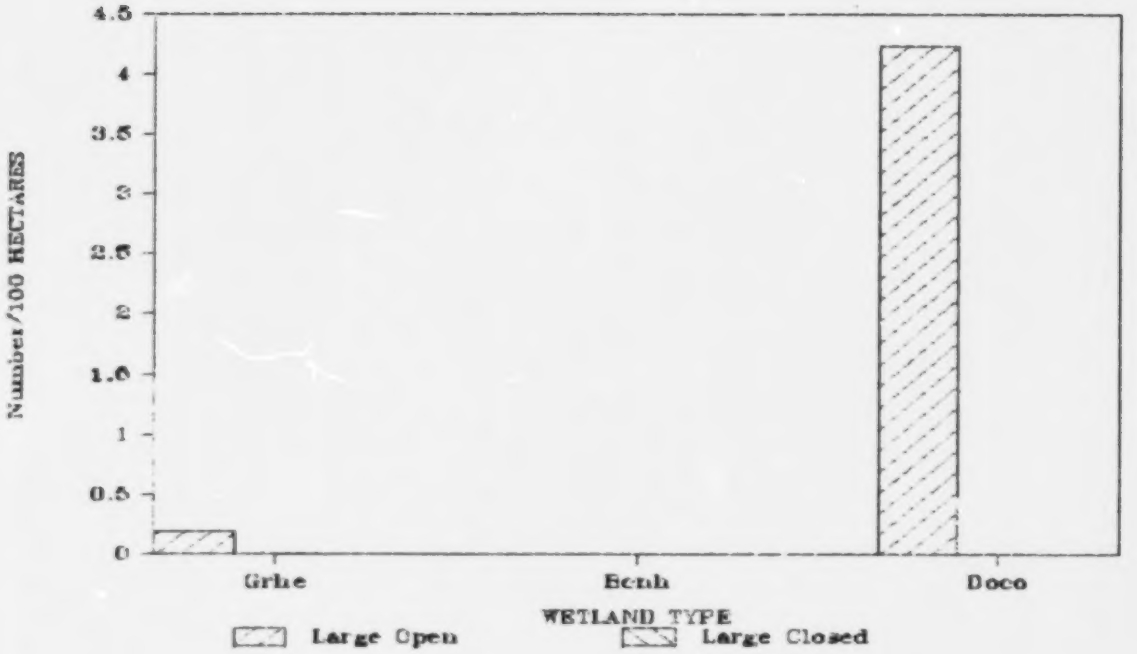

Figure 3.6.36. Density of herons and cormorants in large wetlands during the fall waterfowl surveys.

Table 3.7.1. Density of adult birds and numbers of young (in parenthesis) observed in wetlands during the summer wetland survey, Elk Island National Park, 1984.

	WETLAND				
	#1	#2	#3	#6	#9
Location (UTM)	UQ792532	UQ824507	UQ804503	UQ778472	UQ774449
area	0.27 ha	1.2 ha	2.4 ha	2.0 ha	3.7 ha
Description	(pothole	intermediate	intermediate	intermediate	intermediate
	(closed	closed	open	closed	open
Horned Grebe					0.1
Green-winged Teal			1.0	1.0	
Mallard	6.5		0.4 (7)	1.4 (8)	0.4 (2)
Blue-winged Teal	7.4		1.2	1.1	0.2
Gadwall			0.5		0.4
American Wigeon			0.3	0.5	0.1
Canvasback			0.3 (1)		
Ring-necked Duck					0.1
Lesser Scaup	5.5	1.7	0.3		1.6 (3)
Bufflehead	3.7 (5)		0.6 (5)		0.4
Killdeer	1.8	0.8		0.1	0.1
Spotted Sandpiper			0.5	0.4	0.1
Common Snipe	1.8				
California Gull					0.1
Tree Swallow	6.5		0.2	0.1	0.3
Swamp Sparrow	1.8				
Red-winged Blackbird	13.9	5.0	2.2	1.5	1.0

Each of another 24 wetlands was visited once between June 21 and July 9, 1984. Birds observed in these wetlands included a total of 18 Mallards with 6 ducklings, 12 Blue-winged Teal, 13 Lesser Scaup, 5 Sora, 2 American Coots with one young, 5 Spotted Sandpipers, 4 Eastern Kingbirds, 4 Tree Swallows with one nest observed, and 50 Red-winged Blackbirds. Birds observed flying over the survey wetlands or located along the perimeter of the wetlands included Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Least Flycatcher, Black-capped Chickadee, American Robin, Cedar Waxwing, Red-eyed Vireo, Yellow Warbler, Common Yellowthroat, Brown-headed Cowbird and Northern Oriole. Mallard, Blue-winged Teal and Lesser Scaup were again the common ducks in these wetlands. Birds recorded as flyovers or wetland edge occurrences are not simply wanderers from from adjacent habitats. Wetlands such as beaver ponds offer dead trees which are attractive to feeding woodpeckers. Insects emerging from the wetlands attract insect-eating birds. Willow thickets often found on wetland margins offer another habitat for nesting and feeding.

3.8 Raptors

The most commonly observed raptor in the park is the Red-tailed Hawk. Warden records list two active Red-tailed Hawk nests - one in a CS vegetation type and one in an A vegetation type. One active nest was observed in the south part of the bison paddock in early June 1984. Later in the summer (August), two young were perched about 50 m from the nest site. Three other active Red-tail nests were found in 1984. Two were located along the Wood Bison Trail in the Isolation Area (UTM

UQ762342, UQ763336) in PS-6 RH5 ecosites. The other nest was found east of the horse barn (UTM UQ790379) in a PS-7 U2 ecosite. Casual observations of Red-tailed Hawks come from many vegetation types (Table 3.8.1).

The Great Horned Owl is also a common raptor of the park. One active nest was recorded in a PS-7 biophysical unit west of Astotin Lake in January 1983. Great Horned Owls have been observed in many vegetation types in the park (Table 3.8.1).

Broad-winged Hawks were frequently observed in the area of the south gate during the spring and summer of 1984 and were presumably nesting in this area.

A Merlin was observed around Crane Island in 1984. The behaviour of the bird suggested that a nest was nearby.

Two Northern Goshawks were observed in 1984. One was seen on May 16 at Tawayik Lake and the other was seen west of the golf course on September 9.

A Sharp-shinned Hawk was observed on Bird Transect #7 in June 1984.

Records of other species from warden observations are listed in Table 3.8.1. Sixteen raptor species are listed.

The Lamont Biology Club searched for active raptor nests in the park. One active nest was located at UTM UQ795402 in a GP-5 RU4 biophysical unit but the species was not identified. Twelve inactive nests were also found - 1 in CS-2, 5 in G-8 U3, 2 in GP-5 R4, 1 in GP-6 R4, 1 in GP-8 U3, 1 in PG-8 RH4 and 1 in PS-5 H5. The five nests located in G-8 U3 units were all in the vicinity of the bison paddock. Users of these nests may have included corvids as well as hawks and owls.

Table 3.8.1. Casual observations of raptors in Elk Island National Park, 1977 to 1983, by vegetation type (from warden records). Active nests in parentheses.

	VEGETATION TYPE							
	G	GP,PG	P,PS,SP	C,CS,SC,S	A	D	M	Lake
Bald Eagle			7	1		1		2
Northern Harrier	1	1		1				2
Sharp-shinned Hawk						1		1
Cooper's Hawk				1		1		1
Northern Goshawk		2	3					1
Broad-winged Hawk		2	3					
Swainson's Hawk		1					1	
Red-tailed Hawk	1	6	11	5(1)	3(1)	2		
Rough-legged Hawk	1				1			
Golden Eagle		1	3	1				
American Kestrel			1					
Merlin			1					2
Great Horned Owl	1	7	14(2)	1		5		
Northern Hawk Owl			2					
Great Gray Owl		2						
Short-eared Owl						1		

3.9 Colonial Birds

The Double-crested Cormorant, Great Blue Heron, Black-crowned Night Heron, American Bittern and Black Tern are treated here as colonial birds. Information on these species is from waterfowl surveys, casual observations, a search effort aimed at colonial birds, and historical records.

3.9.1 Double-crested Cormorant

Cormorants were observed on Astotin Lake during the spring and fall 1984 waterfowl surveys. These birds were commonly observed roosting on Mink Island. Twenty-three cormorants were roosting on Mink Island on June 10, 1984. On June 11, 1984 13 cormorants were observed roosting on deadfall on the southwest edge of Lamont Island and 10 birds were roosting on "the Warden's Point" (UTM UQ773497). The cormorants were also swimming and diving in the lake presumably feeding on sticklebacks (Culaea inconstans), fathead minnows (Pimephales promelas) or invertebrates.

The flight direction of cormorants flying over the park was recorded in 1984 in an attempt to find wetlands used by the cormorants outside the park. No conclusion could be drawn about other waterbodies used by the birds as no pattern was detected in the flight directions.

Observations of cormorants were reviewed in warden files. Prior to 1981, the largest group observed consisted of six birds. In 1981, a flock of twelve was observed on Astotin Lake. A flock of 127 was observed in the following year. Forty cormorants were recorded roosting on Mink Island in May 1983.

3.9.2 Great Blue Heron

Great Blue Herons recorded during the spring waterfowl survey were along the edge of large open wetlands. Herons recorded in the fall survey were in closed potholes and in large open wetlands. Throughout the summer, herons were observed feeding in potholes and along lakeshores in most areas of the park. Most heron observations are of birds flying overhead.

Herons have nested in the park in the past, were found nesting in the park in 1984 and continue to nest just outside the park on Blackfoot Lake in the Blackfoot Grazing Reserve. Herons were reported nesting in spruce trees around Astotin Lake in 1937 but later records indicate that these nests were no longer active by 1940. In 1971, nine active nests were located on the northeast shore of Oster Lake. Eleven active nests were found in 1972 in the northeast section of the "out-of-bounds area" of Astotin Lake. "Numerous" heron nests were reported northeast of North Camp on the Ross Creek drainage in the mid-1970s (Graham Snider, pers. comm.). The Blackfoot Heron Colony was visited on July 10, 1984. Seventy-two birds including 20 young-of-the-year birds and 26 active nests were counted. Later in the year (December), 80 nest structures were counted. Warden Joan Williams found two Great Blue Heron nests in spruce trees on Lamont Island in Astotin Lake (June 14, 1984). Five additional heron nests were also reported (unconfirmed) to be in the "out-of-bounds area" of Astotin Lake in 1984. Although herons were commonly found throughout the park in 1984, no further nesting activity was found.

3.9.3. Black-crowned Night Heron

Black-crowned Night Herons were not recorded during the spring and fall 1984 waterfowl surveys. During 1984, 77 night herons were reported in the area of Astotin Lake and these records included 13 young-of-the-year birds. Groups ranged in size from one to 23 adult birds.

A single night heron nest was located in 1984. The nest was found in a tree on Crane Island and at least one young bird was heard in the nest on June 11, 1984. Although no further nests were found, young birds were observed. Six young were seen on the west shoreline of Astotin Lake near the work compound turnoff in August 1984. Seven young were observed on June 28, 1984 near the Recreation Area (UTM UQ787496). It appears that Astotin Lake harbours most of the Black-crowned Night Herons in the park, but other waterbodies have yet to be searched.

3.9.4. American Bittern

The American Bittern is not considerd to be a colonial bird but is included here for taxonomic unity (keeping herons together) and because data were collected by the same methods as for the true colonial birds.

Two bitterns were seen during the summer of 1984. One was seen in a small marsh along the administration road and Astotin Lake. The other bird was observed flying along the southwest shoreline of Astotin Lake. Calls of at least two bitterns were heard in the "out-of-bounds area" of Astotin Lake and a road-killed bittern was found on May 25, 1984 on the Parkway 0.5 km south of the Amisk Wuche Trail. No nests or young were reported in 1984.

Warden records reveal three nest observations - one nest (UTM UQ795465) in 1966 and two nests (UTM UQ765513, UQ825498) in 1975. Although these nest records are all from the North Zone of the park, marshes elsewhere in the park probably also support breeding by this secretive species.

3.9.5. Black Tern

Black Terns were suspected to have nested in the park in 1983. Birds around the pond east of the south elk trap behaved as though they were defending nests. In 1984, one Black Tern nest was discovered on Bird Transect #18 which was located southwest of the south elk trap in the Isolation Area. Tern behaviour in the area of Goose Lake suggested nesting in this area.

Single terns were commonly observed throughout the park during the summer. Flocks of up to 50 birds were seen on Astotin Lake in August and numerous birds inhabited the "Warden's Point". Twenty terns were seen on Blackfoot Lake on July 10, 1984. Terns were frequently observed around Goose Lake in early summer.

4. SELECTED SPECIES ACCOUNTS

The following species accounts present both historical data and our interim understanding of the status and distribution of bird species that occur in EINP.

COMMON LOON (*Gavia immer*) COLO

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The range of the Common Loon extends through virtually all of North America and Western Europe (Salt and Salt 1976). It breeds from as far north as the Yukon to as far south as northern California (Godfrey 1966), and winters along the west and east coasts of North America and the west coast of Europe. It breeds locally throughout the forested parts Canada's prairie provinces. As well, the Common Loon, "may occur as a transient on bodies of water almost anywhere" (Salt and Salt 1976).

Randall (1937) observed six pairs nesting on Astotin Lake and Soper (1951) noted that the species bred on favourable lakes and ponds throughout the park, in moderate numbers. Webb (1970) recorded only five birds on Astotin and none on Big and Little Tawayik, and none on Oster Lake or pond #100. Kemper (1974) stated that the species was being restricted to large, open lakes and she hypothesized it was attempting to avoid contact with humans.

Three Common Loon nests were recorded on Astotin Lake in 1984. The earliest spring record is April 28, 1983 on Astotin Lake and the maximum single counts were of eleven on August 3 and September 3, 1969. The latest fall record is October 12, 1977 on Astotin Lake.

PIED-BILLED GREBE (Podilymbus podiceps) PBGR

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Pied-billed Grebe occurs throughout most of the temperate and tropical regions of North and South America (Godfrey 1966). This species breeds locally throughout Alberta (Salt and Salt 1976).

Randall (1937) called this species common, but shy. Soper (1951) observed it on Mud, Tawayik and Astotin lakes. Griffiths (1969) considered the Pied-billed Grebe a nesting summer resident, but Webb (1970) recorded it as a rare species, with only one observed on Astotin Lake during migration. Kemper (1974) recorded this species successfully nesting on pond number 105 and 234. Park records of Pied-billed Grebe observations are quite scarce, but this is mostly due to the secretiveness of the species.

The earliest spring record is May 7, 1975 on pond #25, the highest count is eight (3 adults and 5 young) on pond #234 on July 16, 1973 and the latest fall record is a single bird seen on Astotin Lake on October 24, 1969.

HORNED GREBE (Colymbus auritus) HOGR

Status and Distribution

Spring: migrant

Summer: resident - nests

Autumn: migrant

Winter: not recorded

The Horned Grebe breeds throughout the temperate regions of North America as far north as Old Crow, Yukon (Godfrey 1966). In Alberta, this species nests locally in all areas except the Rocky Mountains (Salt and Salt 1976). In Elk Island, Horned Grebes are most common on ponds of one to ten acres, which have large amounts of emergent vegetation. An exception is Tawayik Lake, which had several nesting pairs (Kemper 1973). In the wood bison area, Graham (1983) found breeding pairs on Bailey and Flyingshot lakes.

Historically Horned Grebes were found throughout the park on most every lake and pond with some ponds having more than one pair (Randall 1937, Soper 1951). In 1970, the checklist of birds rated it as a summer visitor (Griffiths 1979, Webb 1970), but not common throughout the park. In 1973, of the 99 wetlands surveyed, only six had Horned Grebes (Kemper 1974). Graham (1983) found Horned Grebes on three of five lakes surveyed in the Wood Bison Area.

The earliest spring record is May 4, 1975 on Astotin Lake; the maximum counts are on Tawayik and Flyingshot lakes of 150 birds each on June 15, 1979. The latest fall record is October 13 in1969 on Astotin Lake.

RED-NECKED GREBE (Podiceps grisegana) REGR

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Red-necked Grebe ranges from North America to Eurasia. It breeds from as far north as Alaska and the Yukon, to as far east as Ontario and south to Washington and Minnesota (Salt and Salt 1976). Although this species winters along the Pacific and Atlantic coast, it is occasionally found on the Great Lakes and interior of British Columbia (Godfrey 1966).

Randall (1937) reported the Red-necked Grebes were "common and nested on all suitable lakes" in EINP. In 1951, Soper reported that the species was common, residing on bodies of water with suitable nesting cover. He found that the greatest number were on Astotin Lake where the cover is ideal. Webb (1970) affirmed the popularity of Astotin Lake for this species, with a count of 141 birds. He observed fewer than twenty on most other lakes. Kemper (1974) found that 40% of the park's wetlands were inhabited by the Red-necked Grebe; this included all bodies of water greater than three acres in extent. In 1983, Graham's observations also suggested that the species does not inhabit the smaller lakes in great numbers. Where nesting is concerned, Kevan (1970) noted that nesting in colonies was not common. Rather nests were solitary or in loose colonies. The 1982 EINP Red-necked Grebe survey on Astotin Lake showed that grebe breeding populations have been increasing since 1978.

The earliest spring record is April 24, 1983 on Astotin Lake. The maximum recorded count is 150 individuals on June 27, 1979 in the Wood Bison Area. The latest fall record is October 15 in 1969.

EARED GREBE (Podiceps nigricollis) EAGR

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Eared Grebe breeds in western Canada only in central and southeast British Columbia, in central and southern Alberta and Saskatchewan, and in southwest Manitoba (Godfrey 1966). In Alberta, "the main breeding range of the Eared Grebe coincides roughly with the prairies and parklands" (Salt and Salt 1976).

Randall (1937) noted two small colonies on Astotin Lake. Kemper (1974) stated that the status of Eared Grebes was uncertain; she found only two colonies, both of over 50 members on Big Tawayik and Blackfoot lakes. Soper (1951) recorded only two pairs in Elk Island National Park, but Webb (1970) found small colonies on four lakes (Oster, Astotin and both Tawayiks). Graham (1983) found colonies of Eared Grebes on Walter, Flyingshot and Goose lakes in his ground survey; the Goose Lake colony had 393 individuals.

Concentrations of Eared Grebes were noted during 1984 at Tawayik Narrows and Flyingshot Lake (north side), but no nests were located. The earliest spring record is May 3 in 1982 on big Tawayik Lake and the

maximum count was 500 on August 17, 1972 at Tawayik Lake. The latest fall record is October 22 in 1984 on Goose Lake.

WESTERN GREBE (Aechmophorus occidentalis) WEGR

Status and Distribution

Spring: migrant

Summer: visitor (rare)

Autumn: migrant

Winter: not recorded

The Western Grebe breeds only in western Canada, in the Great Plains region and isolated areas in south-central British Columbia (Godfrey 1966). In Alberta, the species breeds throughout most of the prairies, parklands and southern boreal forest, but it is easily displaced by any form of water recreation (Salt and Salt 1976).

Historical, as well as current park records, indicate the the Western Grebe is rare in Elk Island National Park. Randall (1937) saw them only once during migration and Soper (1951) did not record them at all. Webb (1970) mentions this grebe as a migrant, while Griffiths (1979) calls it a questionable migrant. Kemper (1974) observed an individual on Adamson Lake in early May, the only observation indicated in all of her surveys. Park records show small groups on Astotin Lake during the 1981 and 1983 annual bird counts and a mortality of unknown cause on Astotin Lake in 1983.

The earliest spring record is May 8 in 1970 on Astotin Lake and the maximum count is 36 on Astotin Lake on June 11, 1977. The latest fall record is October 29 in 1971 on Astotin Lake.

AMERICAN WHITE PELICAN (Pelecanus erythrorhynchos) WHPE

Status and Distribution

Spring: rare visitor

Summer: rare visitor

Autumn: rare visitor

Winter: not recorded

The American White Pelican is a local, summer resident in the western provinces of Canada and breeds locally in central British Columbia, northeastern Alberta and northwestern and southern Saskatchewan (Godfrey 1966). In Alberta, the pelican's breeding range has been reduced to a few isolated colonies in the Wood Buffalo National Park area (Salt and Salt 1976).

Randall (1937) stated that in EINP "occasionally a flock alights on one of the larger lakes during migration", while Soper (1951) stated that he did not observe any pelicans and that the species does not breed in the park, although it formerly did at several places in the Beaver Hills, such as Ministik and Miquelon lakes.

The White Pelican is a rare and sporadic migrant in the park area with only seven sightings recorded in the past 20 years. Griffiths (1979) recorded this species as a migrant only. Webb (1970) had three sightings of White Pelicans in his surveys in 1969, two on May 29, one on July 23 and one in August, all on Astotin Lake. Kemper (1974) called the species uncommon and recorded none.

The earliest spring record is May 6 in 1966 on Astotin Lake. Maximum recorded count is two on May 29, 1969 on Astotin Lake. The

latest fall record is on November 22 in 1974 west of Trappers Lake, just outside the park.

DOUBLE-CRESTED CORMORANT (Phalacrocorax auritus) DOCO

Status and Distribution

Spring: migrant

Summer: visitor - possible nesting

Autumn: migrant

Winter: not recorded

The Double-crested Cormorant breeds in southwestern Alaska and in temperate and tropical areas of North America east of the Rocky Mountains (Godfrey 1966). Most Alberta breeding colonies are in the boreal forest region, although some lakes in the parklands and prairies have colonies (Salt and Salt 1976).

Both Randall (1937) and Soper (1951) recorded this species as a rare migrant, but not a summer resident. Griffiths (1979) also recorded the cormorant as a migrant, as did Kemper (1974) who stated that the park, "does not provide suitable nesting habitat or food supply".

The EINP historical wildlife file contains only two records, each of a single individual on Astotin Lake. Current warden wildlife records, though, show a continual increase in numbers of cormorants roosting during May, June and July on Mink Island on Astotin Lake. Since 1977, when two birds were observed on Astotin Lake, the observation numbers have been rising: 6 in 1978, 12 in 1981, 37 in 1982 and 127 in 1983, all on Astotin Lake. In 1984 up to 100 were observed on Mink Island and cormorants were observed diving, apparently feeding, on Astotin Lake.

There is a possibility that, given adequate protection from disturbance, this recently-established nonbreeding population may establish a nesting colony on Astotin Lake.

The earliest spring record is April 25 in 1983 on Astotin Lake. Maximum recorded count is 127 on Mink Island on Astotin Lake on August 21, 1982. The latest fall record is September 16 in 1976 on Astotin Lake.

AMERICAN BITTERN (Botaurus lentiginosus) AMBI

Status and Distribution

Spring: rare migrant

Summer: rare resident - nesting

Autumn: rare migrant

Winter: not recorded

The American Bittern is found throughout most of North America and breeds as far north as Great Slave Lake, west to the interior of British Columbia, as far east as Newfoundland, and south to the central United States (Salt and Salt 1976). Where habitat is suitable, the American Bittern breeds throughout the prairie provinces (Godfrey 1966). It winters occasionally in British Columbia, but primarily in the central and southern United States.

In 1937, Randall stated that bitterns were uncommon but he found several pairs nesting in cattail beds. Soper (1951) reported the species was a "rather uncommon" summer resident. In 1970, Webb considered the bittern a summer resident, possibly nesting. Kemper (1974) did not see any during her studies.

During the 1984 avifauna inventory, American Bitterns were present wherever there were extensive cattail beds, including the northwest arm of Astotin Lake, Goose Lake, and a marsh southeast of the bison paddock. It appears that the species is limited only by availability and extent of suitable habitat in EINP.

The earliest spring record is May 15 in 1970 on Astotin Lake and the maximum recorded count is three on September 16 and 18, 1981 in the Wood Bison Area. The latest fall record is September 13 in 1974 on Astotin Lake.

GREAT BLUE HERON (Ardea herodias) GRHE

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Great Blue Heron breeds throughout most of the temperate and tropical regions of North America, although it is local west of the Rocky Mountains (Godfrey 1966). In Alberta the species occurs south of Lesser Slave Lake and east of the Rockies, although the number and size of breeding colonies have diminished over the last century (Salt and Salt 1976).

In Elk Island National Park this heron has always been a regular but uncommon summer resident. Randall (1937) states that seven pairs of this species were nesting on an island on Astotin Lake. Soper (1951) states that he found this colony unused in 1940. Griffiths (1969) lists

this species as a nesting summer visitor. Webb (1970) lists Great Blue Herons as summer visitors and possibly nesting while Kemper (1974) states that adults were observed frequently but records "still do not substantiate the rearing of young".

In 1972, 13 nests in eight trees near pond #29 were monitored throughout the breeding season. By July 20 six nests contained full-grown young. This colony has not been checked subsequently. During the avifauna inventory in 1984, three nests were located on Lamont and Crane islands in Astotin Lake; others may have been missed due to their locations in the dense spruce canopy. The only other known colony in the area is a large colony on Blackfoot Lake, just outside the park. Other colonies probably exist elsewhere in the park.

The earliest spring record is April 19 in 1971 at Astotin Lake and the maximum count is 90 on April 24, 1983 at Blackfoot Lake, just outside the park. The latest fall record is September 24 in 1969 at Astotin Lake.

BLACK-CROWNED NIGHT HERON (Nycticorax nycticorax) BCNH

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

Widely distributed throughout the world, the Black-crowned Night Heron is found from southern Canada to South America (Godfrey 1966). However, it is rare in British Columbia and although now quite common in

Alberta, is was not recorded in this province until 1958 (Salt and Salt 1976).

In Elk Island National Park, the Black-crowned Night Heron was first recorded in 1969 when Webb (1970) counted four birds on Astotin Lake. He noted that they were nesting. Kemper (1974) observed a flock of seven adults which flew between Astotin Lake and a heronry on the east side of ponds #44-49. During 1984 more than 70 Black-crowned Night Herons frequented Astotin Lake, and a nest was found on Lamont Island.

May 13 in 1970 is the earliest spring record. The maximum recorded count is 15 on May 18, 1982 at Astotin Lake. The latest fall record is October 25 in 1969, at Astotin Lake.

TUNDRA SWAN (Olor columbianus) WHSN

Status and Distribution

Spring: rare migrant

Summer: not recorded

Autumn: rare migrant

Winter: not recorded

The Tundra Swan breeds in Alaska and the Canadian low arctic. It winters mainly on the Pacific and Atlantic coasts of the United States (Godfrey 1966). Migration is generally through the interior of the continent and Tundra Swans are common in migration throughout the prairie provinces (Salt and Salt 1976).

In Elk Island National Park, Randall (1937) observed several small flocks of Tundra Swans passing overhead during spring migration. Soper (1951) did not see any. However, he stated that there were previous park

records of the species on Astotin Lake during migration. Webb (1970) observed no swans and listed this species as a rare spring and fall migrant. On October 9, 1973 Kemper (1974) observed a flock of 36 Tundra Swans on Tawayik Lake and four on Flyingshot Lake.

During the avifauna inventory in 1984 flocks of Tundra Swans were observed regularly during both spring and fall migrations. Most of these were flying overhead and it appears that the major staging areas for this species are in more open country outside the park.

The earliest spring record is April 20 on Astotin Lake. The maximum count was 200 on Astotin Lake on April 23, 1981. The latest fall record is November 13 on Tawayik Lake.

TRUMPETER SWAN (Olor buccinator) TRSN

Status and Distribution:

Spring: not recorded

Summer: reintroduced - rare

Autumn: not recorded

Winter: Not recorded

The Trumpeter Swan breeds locally in northwestern North America (Godfrey 1966). In Alberta this species nests in the Grande Prairie area and the Cypress Hills and has recently been found in other localities in southern Alberta (Salt and Salt 1976).

Although the Trumpeter Swan is believed to have formerly nested in the EINP area (Brechtel 1982), no park studies mention the species and no historical records have been found.

Trumpeter Swans were released in EINP by the Canadian Wildlife Service and Parks Canada jointly during the summer and fall in 1983 and 1984 to reintroduce this endangered species into its former habitat. In 1983, 17 birds (4 adults and 13 cygnets) were placed in four lakes in Elk Island in an attempt to establish a population which would migrate between Elk Island and Canada's west coast. In 1984, 13 (3 adults and 10 cygnets) were placed in two lakes in the Wood Bison Area. Neither stocking was successful and at present one adult from 1983 is wintering at Wabamun Lake and one cygnet from 1983 is apparently wintering in the Tri-State (Montana, Wyoming and Idaho) area. Coyote predation and disorientation appear to have been factors in the failure. The future of this reintroduction project is unknown.

GREATER WHITE-FRONTED GOOSE (Anser albifrons) WHGO

Status and Distribution

Spring: rare migrant

Summer: not recorded

Autumn: rare migrant

Winter: not recorded

The White-fronted Goose breeds from the northern Yukon and northern Mackenzie to Keewatin. It is a spring and fall transient of the prairie provinces but rarely occurs further east (Godfrey 1966). It winters mainly in the southern United States (Salt and Salt 1976). Occasionally a few winter in southwestern British Columbia.

Many flocks of the White-fronted Goose were seen passing over Elk Island National Park during the spring and fall migration, rarely landing

on the lakes (Randall 1937). He felt the species preferred more open areas. Soper (1951) observed the species passing over on migration, rarely landing to feed or rest. Webb (1970) lists the bird as a spring and fall migrant. In 1973, Kemper (1974) could find no records of the species landing in the park although it frequently used Beaverhill Lake to the southeast.

The earliest spring record is May 4 in 1970 on pond #37, with the maximum count being 200 on September 26, 1970 on Astotin Lake. The latest fall record is September 28 in 1960 on Astotin Lake.

SNOW GOOSE (Chen caerulescens) SNGO

Status and Distribution

Spring: rare migrant

Summer: not recorded

Autumn: rare migrant

Winter: not recorded

The Snow Goose breeds in the arctic from Baffin Island west to Alaska and along the west coast of Hudson Bay (Salt and Salt 1976). It winters mainly from southern British Columbia to southern California and migrates throughout the prairie provinces (Salt and Salt 1976).

Randall (1937) reported that this species was a spring and fall migrant and that it rarely landed on park lakes to feed or rest, probably finding the tree enclosed waterbodies undesirable. Soper (1951) mentioned that park personnel had observed the species during migration and that the Snow Goose appeared to be more abundant than the White-fronted Goose but less abundant than the Canada Goose. Neither Webb

(1970) nor Kemper (1974) observed Snow Geese. Migrant flocks were recorded in 1982 and 1983, but none were observed during the 1984 avifauna inventory.

The earliest spring record is February 13 in 1982 on pond #230 in the Wood Bison Area. Maximum recorded count is 100 on October 12, 1965 on Astotin Lake. The latest fall record is October 12 in 1965 on Astotin Lake.

ROSS' GOOSE (Chen rossii) ROGO

Status and Distribution

Spring: rare migrant

Summer: rare visitor

Autumn: rare migrant

Winter: not recorded

Ross' Goose breeds locally along the arctic coast from Perry River to Southhampton Island, and occasionally at Banks Island (Godfrey 1966). It winters in the Sacramento and San Joachim valleys of California and less commonly in Louisiana and Texas. A scarce migrant in Manitoba, the Ross' Goose migrates mainly over eastern Alberta and western Saskatchewan (Salt and Salt 1976). Randall (1937) reported many flocks of the species flying over. Soper (1951) considered this species "comparatively rare in central and east-central Alberta" with only a few individuals observed during his studies; he recorded it as a rare spring and fall migrant. Randall's (1937) checklist is the only indication on record that this species has ever occurred in or over the park.

CANADA GOOSE (Branta canadensis)

Status and Distribution

Spring: migrant

Summer: uncommon resident

Autumn: migrant

Winter: not recorded

The Canada Goose breeds from the arctic to the northern United States. It winters on the coast of British Columbia, extreme southern Canada and the southern states (Godfrey 1966). "Canada Geese breed locally in all parts of the prairie provinces including the Rocky Mountains" but appear more commonly as transients (Salt and Salt 1976).

In 1937, Randall noted many flocks of Canada Geese passing over on spring and fall migration but felt that they were adverse to landing on the lakes. He felt they did not favour forested areas. Soper (1951) drew the same conclusion as he observed flocks only occasionally land on lakes, especially Astotin and Tawayik. He felt that geese preferred Beaverhill Lake, stating that many thousands visited it. He did not find any present in the park during summer.

In 1969, Weber not only observed the species as a migrant but he sighted a few nesting pairs, including one on Astotin Lake. Kemper (1974) noted a nesting pair with three young in May and June of 1973. Graham (1983) counted five Canada Geese on Flyingshot Lake and one nest. On Goose Lake he sighted 10 birds. During the 1984 avifauna inventory broods of recently hatched Canada Geese were seen in several locations. It appears that the Canada Goose is on the increase in Elk Island National Park.

The earliest spring record is March 16 on pond #121 and the maximum count and latest fall record is 200 on October 30, 1981 on Astotin Lake.

WOOD DUCK (Aix sponsa) WODU

Status and Distribution

Spring: not recorded

Summer: accidental

Autumn: not recorded

Winter: not recorded

The Wood Duck breeds from southern British Columbia, to central Saskatchewan, southern Manitoba and Ontario and parts of the Maritimes (Godfrey 1966). It is rare in Alberta. It winters in the southern United States and Mexico (Salt and Salt 1976).

Griffiths' (1969) Provisional Checklist of Birds listed the species as a rare summer nesting resident.

The only records are one male on August 24, 1966 on Astotin Lake, and two sightings during fall migration surveys in September 1984. No more than two have been sighted at any one time.

GREEN-WINGED TEAL (Anas crecca) GRTE

Status and Distribution

Spring: migrant

Summer: resident, nesting

Autumn: migrant

Winter: not recorded

The Green-winged Teal breeds from middle Alaska and the northwestern and middle Canadian mainland, to as far south as California. It winters on the coast of British Columbia (Godfrey 1966) and in the southern United States. Found nesting in all parts of the prairie provinces, it is least common in the mountains and seems to prefer the more northern parts of the prairies (Salt and Salt 1976).

In 1937, Randall listed the species as unusually scarce with only a few pairs nesting in the park. Soper (1951) considered the species to still be very scarce throughout southern Alberta. His only record in EINP was late July 1940, when a few adults were seen on Astotin Lake. No juveniles were observed. Webb (1970), however, considered the Green-winged Teal to be among the most abundant species on the ten largest lakes as well as on ponds less than 0.8 km in length. Kemper (1974) considered the Green-winged Teal to be the least common of the dabbling ducks and an uncommon autumn resident. Graham (1983) indicated that this species made up about 5% of the waterfowl counted in his surveys. It appears that this species fluctuated in abundance in EINP.

The earliest spring record is May 4 in 1970 on a marsh just south of Tawayik Lake. The maximum count is 42 individuals on May 22, 1970 on Tawayik Lake. The latest record is September 17 in 1969 on pond #304.

MALLARD (Anas platyrhynchos) MALL

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Mallard occurs throughout the northern hemisphere (Salt and Salt 1976). In Canada, it is most common in the western provinces and decreases in numbers eastward (Godfrey 1966). Mallards breed most abundantly in the prairies and parklands. The species occurs throughout Alberta and remains in the province all winter, wherever there are extensive areas of open water (Salt and Salt 1976).

Randall (1937) reported that the species was common and bred in large numbers in EINP. Soper (1951) noted that Mallards were present in large numbers during migration and were common breeders in the park. He recorded mallards on all the larger lakes and on numerous ponds and sloughs. Kemper (1974) reported that the Mallard was the second most common waterfowl species. Graham (1983) affirms that the Mallard numbers are only exceeded by the Lesser Scaup.

The earliest spring record is April 5 in 1979 on Mud Lake, the maximum single count is 450 on October 2, 1970 on Tawayik Lake. The latest fall record is November 14 in 1969 on Astotin Lake.

NORTHERN PINTAIL (Anus acuta) PINT

Status and Distribution

Spring: rare migrant

Summer: rare resident

Autumn: rare migrant

Winter: not recorded

The Pintail breeds from the arctic coast west to the Great Lakes, south to the northern United States, and throughout the prairie

provinces. It winters in the southern states (Salt and Salt 1976) and along the coast of British Columbia (Godfrey 1966).

In 1937, Randall recorded that the species was scarce and that there were only a few pairs nesting in the park. The same type of report was given by Soper (1951), stating that "obviously few resort to the park". He noted individuals in 1940 on Astotin and Tawayik lakes. In 1943, he observed three on Astotin Lake. Webb (1970) recorded the pintail nesting in the park, observing five birds on Astotin, one on Big Tawayik and eight on Little Tawayik. Kemper (1974) felt that the species was on the increase in the park, recording 1,020 pintails on Tawayik Lake July 9 and 1,380 on Flyingshot Lake the same day. During the avifauna inventory of 1984, pintails were regularly observed on migration but were rare during the breeding season.

The earliest spring record is April 8 in 1969 west of Oster Lake, just outside the park. The maximum recorded count, outside of Kemper's records, is 15 on June 30, 1972 at Tawayik Lake. The latest fall record is September 2 in 1971 on pond #305.

BLUE-WINGED TEAL (Anas discors) BLTE

Status and Distribution

Spring: migrant

Summer: resident, nesting

Autumn: migrant

Winter: not recorded

The Blue-winged Teal breeds in southern Yukon and Alaska, most of southern Canada, south to California and as far east as Cape Breton

Island (Godfrey 1966). In Alberta the species breeds throughout the province, being the most common teal on the prairies and in the park-lands. It is most abundant in the southern part of the province (Salt and Salt 1976).

Randall (1937) remarked that the blue-wing was "more plentiful" than the green-wing. Soper (1951) also stated that the species was more common that the green-wing but only moderately so. Webb (1970), however, found that the Green-winged Teal was the more common of the two species. Kemper (1974) and Graham (1983) both considered this species to be one of the most common ducks in ZINP.

The earliest spring record is May 2 in, 1970 on pond #304. Maximum count is 200 on August 4, 1971 on Astotin Lake. The latest fall record is September 28 in 1970 on Oster Lake.

CINNAMON TEAL (Anas cyanoptera)

Status and Distribution

Spring: migrant (rare)

Summer: rare resident, nesting

Autumn: not recorded

Winter: not recorded

The Cinnamon Teal breeds locally in western North America (Godfrey 1966). In Alberta it apparently only became established as a nesting species in the 1950s. It now occurs as an uncommon but regular summer resident as far north as Tofield (Salt and Salt 1976).

In Elk Island National Park the Cinnamon Teal was not recorded by either Randall (1937) or Soper (1951). Griffiths (1979), in her

Provisional Checklist of Birds, called this species rare and possibly nesting. Webb (1970) found at least one pair nesting. Kemper (1974) observed none during her studies. Graham (1983) did not observe the species in his surveys of the Wood Bison Area.

The earliest spring record is May 5, 1969. The latest record is June 3 in 1982.

NORTHERN SHOVELER (Anas clypeata) SHOV

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Northern Shoveler breeds from Alaska east to Manitoba (Godfrey 1966). It nests throughout Alberta and Saskatchewan but is rare in the mountains. It winters on the Pacific coast and in the southern states to Central America (Salt and Salt 1976).

In 1937, Randall recorded the shoveler as common. Soper (1951) noted that from 1937 to 1940 there had been a marked decline in the species, followed by a gradual increase from 1940 to 1950. A subsequent decline is indicated by the fact that both Webb (1970) and Kemper (1974) reported the species to be uncommon. Graham (1983) found small numbers of shovelers on Bailey, Blackfoot, and Goose lakes and counted 54 on Flyingshot Lake.

The earliest spring record is May 2 in 1975 on pond #13. Maximum count is 54 in June 1983 on Flyingshot Lake. The latest fall record is October 11 in 1969 on Astotin Lake.

GADWALL (Anas strepera) GADW

Status and Distribution

Spring: not recorded

Summer: uncommon resident - nesting

Autumn: rare migrant

Winter: not recorded

The Gadwall breeds in southern Canada, as far east as Ontario and into the northern United States. It winters along the coast of British Columbia and throughout the southern United States and Mexico (Salt and Salt 1976).

Randall (1937) listed the Gadwall as common and found it nesting "in fairly large numbers on the islands and in the more open parts of the bush" often at a considerable distance from water. Soper (1951) recorded Gadwalls as being moderately common summer residents who nest in the semi-open woodlands "adjoining many of the water areas and upon islands on Astotin Lake." Webb (1970) felt that while the Gadwall nested in the park, its status had changed from moderately common to rare. Kemper (1974) reported that the species was locally common, but nowhere abundant. In 1973, it was found that over half the sightings of the Gadwall were in the Wood Bison Area. During the 1984 avifauna inventory Gadwalls were found in small numbers throughout the park. This species

appears to have declined in abundance since Randall's studies in the 1930s.

The earliest spring record is May 6 in 1970 on Astotin Lake and the maximum count recorded is 250 on September 17, 1969 on pond #1. The latest fall record is October 26 in 1969 on Astotin Lake.

AMERICAN WIGEON (Anas americana) AMWI

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The American Wigeon breeds from Hudson Bay west to Alaska, south through Canada to northern California. In Canada its range extends east barely into Ontario (Godfrey 1966). The species is a common breeding species throughout most of Alberta, except in the mountains where it is only a migrant (Salt and Salt 1976).

Randall (1937) listed this species as fairly common and nesting in the park. Soper (1951) recorded it as abundant and found the largest concentration on Astotin Lake. Webb (1970) and Kemper (1974) both considered the wigeon one of the most abundant ducks in the park, ranking in the top three of the dabbling ducks.

The earliest spring record is April 16 in 1969 on Astotin Lake. Maximum count is 900 on July 18, 1970 on Tawayik Lake. The latest fall record is October 30 in 1969 on pond #16.

REDHEAD (Aythya americana)

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Redhead breeds in British Columbia, Alberta, Saskatchewan and central and southern Manitoba, and locally in eastern Canada (Godfrey 1966). It is common throughout Alberta except in the mountains, and winters from southern British Columbia to Mexico (Salt and Salt 1976).

Randall (1937) recorded the Redhead as a common resident nesting in the park. Soper (1951) considered the species only fairly common, especially on Astotin Lake. Webb (1970) found the Redhead to be one of the most frequent species on ponds less than 0.8 km in length. Kemper (1974) observed that the species was not overly abundant in the park and that it was not known whether the apparent decline in the population indicated a population decrease or if it was just shifting nesting grounds. Graham (1983) observed a few Redheads on Goose Lake and considerable numbers on Bailey and Flyingshot lakes in June 1983.

The earliest spring record is May 2 in 1970 on ponds #86 and #52. Maximum count is 250 on October 15, 1971 on Astotin Lake. The latest seasonal record is October 25 in 1969 on Astotin Lake.

RING-NECKED DUCK (Aythya collaris) RIDU

Status and Distribution

Spring: migrant

Summer: resident - nesting

Autumn: migrant

Winter: not recorded

The Ring-necked Duck breeds from central and southern British Columbia, through central Alberta and Saskatchewan, to the eastern provinces (Godfrey 1966). It winters along the British Columbia coast and in the southern United States (Salt and Salt 1976).

Neither Randall (1937) nor Soper (1951) recorded this species. Webb (1970), however, considered this to be a common breeding species and among the most frequent species on ponds less than 0.8 km in length. Kemper (1974) observed the species on only 11 wetlands during the nesting season. Graham (1983) sighted 26 Ring-necked Ducks on Flyingshot Lake and a pair on each of Bailey and Goose lakes. In the present inventory, ring-necks were found in small numbers throughout the park in spring and fall. On October 1, 1984, 56 ring-necks were observed on that day's migration survey.

The earliest spring record is April 25 in 1974 on Astotin Lake. The maximum count is 90 on May 22 in 1970 on Tawayik Lake. The latest fall record is October 2 in 1970 on Tawayik Lake.

5. RECOMMENDATIONS

5.1 Project Completion

The single year's data gathered during the 1984/85 field season are inadequate for drawing sound conclusions upon which to base avifaunal management in EINP. In addition to gaps in the data base which were to have been infilled during the 1985/86 season, there is a requirement for a large enough pool of data that sound statistical inferences can be drawn.

In light of this need for at least two year's data, the following outline is offered as the best way to complete this avifauna inventory. Details on specific aspects of the study are followed by a proposed time/action schedule and staffing requirements.

5.1.1. Waterfowl surveys

Sampling of a single migration survey route in spring and a single one in autumn - ideally, the survey routes oriented to terrestrial birds as well - should adequately show arrival and departure dates and peak periods for most migrants. Waterfowl migration surveys are unnecessary and need not be carried out.

A continuation of 1984 breeding waterfowl work (pond and wetland surveys) will allow compilation, and comparison, of two years' data. The same ponds and wetlands should be surveyed as in 1984.

5.1.2. Red-necked Grebe monitoring study

About May 10 to 15 the Red-necked Grebe nesting population on Astotin Lake should be counted in the same manner as has been done

previously. We recommend that the results of this and previous surveys, and the history of recreation management on Astotin Lake, be written up and submitted to the Journal of Wildlife Management in order that other resource managers can benefit from the EINP experience.

5.1.3. Uncommon species: breeding records

During the breeding season (April and May for waterfowl; May through July for most others), a concentrated effort should be made to locate nests or newly-fledged young of rare species whose breeding status is not clearly defined. Some example of these, with possible locations for checking, are given below:

Species	Area
Double-crested Cormorant	Astotin Lake Islands (May)
Great Blue Heron	Astotin Lake Islands (May)
Black-crowned Night Heron	Astotin Lake Islands (May)
Barrow's Goldeneye	Astotin Lake Islands (May)
Short-billed Dowitcher	M-1 and C/S areas (May)
Bonaparte's Gull	UQ810440; other muskeg ponds (May)
Forster's Tern	Astotin and Oster Lakes (May)
Common Tern	Astotin and Oster Lakes (May)
Yellow-bellied Flycatcher	M-1 areas (June)
Great Crested Flycatcher	Long Island, Amisk Wuche trail, NE corner of park (June)
Sedge Wren	UQ768505, UQ732365, Goose Lake (June)
Hermit Thrush	South Zone (June)
Palm Warbler	M-1 areas; Hayburger muskeg (June)
Bobolink	Hay meadow area (June, July)

5.1.4. Raptor nesting

Raptors evidently occur at such low densities that they cannot be efficiently surveyed by standard inventory techniques. Red-tailed Hawks should be counted in May and June since they are visible while hunting and the number of territorial pairs is readily determined by observation. Broad-winged Hawks, accipiters and other species are either too secretive or too uncommon to be efficiently surveyed.

We suggest that all casual raptor observations be recorded during the field season but that for more detailed information on raptor populations, breeding success and habitat use a more specific, detailed study is required.

5.1.5. Breeding bird transect and count plots

Breeding bird transects should be surveyed at the same level of sampling effort as in 1984. A preferred schedule for sampling is given below. The results should be analyzed in the same manner as 1984 results, in order to compare variability between years for each transect and bird species, with those transects and species showing the least variability between years being considered for ongoing monitoring.

Count plots should be continued. The results should be compared with 1984 results to determine between-years variability, and all results should also be lumped together to provide mean densities for each biophysical habitat type based on the largest possible sample size. Based on which type received the least sampling effort in 1984, a list of target biophysical habitat types for further sampling is given below.

Preferred Transect Sampling Schedule

	Observer A	Observer B
First three weeks		
(appr. June 1 - June 20)	1, 2	5, 4
	4	6
	14, 20	8, 7
	19	11, 10
	15, 18	13, 12
	17, 3	9
Last three weeks		
(appr. June 20 - July 10)	4, 5	2, 1
	6	4
	7, 8	20, 14
	10, 11	19
	12, 13	18, 15
	9	3, 17

- transects are sampled in the order shown; thus each will get sampled at least once in the hour centred on sunrise.

Count Plot biophysical habitat type targets

- in decreasing order of priority

TC	GP	MS
GS	LA	SC
C	PG	D
LA	PM	S
SP	CS	M
FP	F	PF

5.1.6 Time/action schedule and staffing

Person-year requirements to complete this inventory would be comparable to staffing for 1984/85. During the peak sampling season (May, June and the first half of July) there will be a requirement for two competent field ornithologists (capable of song and call identification) in addition to other project staff to conduct waterbody surveys, bird colony surveys and nest searches. During the rest of the year a single field ornithologist (project biologist) and one warden would be sufficient to conduct the necessary field work, data analysis and report production. During May, June and July, flexibility should be incorporated into warden work schedules to facilitate early morning field work.

5.2 Avifauna Monitoring and Management Considerations

The items discussed below are grouped according to the six major resource management objectives listed in the Avifauna Management Plan, Elk Island National Park.

Objective 1. Protection

To allow natural processes to operate unhindered and ensure that the avifauna and their habitats remain protected from man-induced interference.

1. Avifauna changes have occurred during the last century in EINP, as is shown by a comparison of Thomas Randall's observations in the 1930s with our information fifty years later.

   It has been hypothesized that fire prevention and ungulate management have been major factors contributing to habitat change in

EINP (C. Blyth, unpublished data). Bird species which have decreased or disappeared from EINP during this century appear to be largely those associated with grasslands or more open parkland-like vegetation than now covers the park.

If Parks Canada intends to manage the park for the maintenance of all bird populations that occur here including such species now rare or absent as Sharp-tailed Grouse, Sprague's Pipit and Say's Phoebe, consideration would have to be given to managing vegetation in such a way as to establish more grassland and aspen groveland habitats in some areas of the park. If investigations indicate that native fescue grassland occurred formerly in EINP, restoration of natural fescue grassland may be dependent on increased frequency of fires and decreased ungulate stocking rates.

2. Prohibition of motorboats on park waters has led to a dramatic increase in Red-necked Grebe numbers at a time when this species is on the decline over much of its range, according to the American Birds Blue List.

These results indicate that the prohibition of motorboats should be continued, and that the results of monitoring Red-necked Grebes on Astotin Lake since the motorboat closure be published in Journal of Wildlife Management to inform land and wildlife managers of the success of this method for restoring grebe populations.

3. The islands of Astotin Lake are important breeding areas for several species of birds. Randall noted their importance to breeding ducks in light of their isolation from such predators as coyotes. Great Blue Herons and Black-crowned Night Herons use the islands both for

nesting and roosting. Double-crested Cormorants roost on Mink Island and may ultimately establish a breeding colony on Astotin Lake. Merlins also breed on Lamont Island.

Disturbance of nesting and roosting birds on these islands can be minimized by declaring the islands out-of-bounds during May, June and July, and by increased efforts to inform boaters of their sensitivity and to ask for voluntary restraint.

Long Island does not appear to be as important to these species as do Mink, Lamont, Crane, North, Grassy and Raspberry Islands. Recreational use of Long Island would not be likely to disturb these species.

4. Coniferous habitats are scarce and of limited extent in EINP, yet they contibute to the diversity segment of the park's avifauna. Particulary in light of the fragmentation of habitats outside the park, we recommend that coniferous and mixed habitats in EINP be protected from development and disturbance wherever possible. Some species - such as Palm Warbler and Swainson's Thrush - may already have ceased to breed in the park due to factors relating to the minimum extent of habitat which they require to sustain breeding populations. Controlled burning should only be in deciduous habitats.

Objective 2. Utilization

To encourage uses of the avifaunal resource that do not conflict with those protective measures stipulated by Objective 1.

1. Elk Island National Park already has a small and growing reputation internationally among birders as a diverse and productive birding

destination. Several eastern species reach the western limits of their ranges here, including the Chestnut-sided Warbler, Sedge Wren and Great Crested Flycatcher. The position of the park at the northern edge of the Aspen Parkland ecoregion, with Boreal Mixedwood elements, results in a diversity of bird species in all seasons.

Bird-watching could be promoted as a passive use of park avifaunal resources, and is unlikely to conflict with protective measures.

2. Bird banding is an activity which has contributed vastly to our understanding of bird ecology and bird migration. Techniques are now well enough developed and perfected that this activity has little or no negative impact on birds. Banding might be considered an acceptable use of the park's avifauna which is, furthermore, in keeping with the park's monitoring objectives (see below).

Objective 3. Public Information

To prepare and disseminate accurate information on matters relating to the avifaunal resource.

1. We recommend that the final report of the avifauna inventory be used to update the EINP bird checklist, and to contribute to other park publications on birds.

Objective 4. Monitoring

To ensure that applied management actions are functioning to prevent man-caused interference to the natural processes and avifaunal resource. Further, to monitor natural cycles, trends and the occurrence of rare and endangered species.

1. While monitoring will detect increases or decreases in park bird populations, monitoring alone will not identify the causes of

population changes. In some cases changes may be due to factors outside the park; in others they may be influenced by park management.

An ongoing banding program would provide data on the migration routes and wintering areas of park bird populations. Pesticide use, clearing of tropical forests and chance events such as storms along migration paths may all influence bird populations in EINP, but in the absence of good data on where these birds go, park resource managers may not be able to clearly identify their management options.

Nest failures or colony abandonment should be investigated to determine the causes. Examination of sterile eggs may detect pesticide concentrations that come from outside the park but are affecting park bird populations. It is essential that avifauna be viewed as a trans-boundary resource, and that its management be considered a broader issue than one of park management alone.

2. Monitoring should indicate trends in the populations of common species which serve as environmental indicators, as well as trends in the status of rare or endangered species.

Based on these two basic criteria, and the guidelines in Section 5.2 of Appendix C, Avifaunal Management Plan, Elk Island National Park, we recommend that the species in Table 5.3.1 be monitored in EINP.

3. There are several options for monitoring the park's avifauna, depending on management priorities and availability of resources. Three are discussed below:

Table 5.3.1. Selected species for monitoring, Elk Island National Park.

	Reason for monitoring				Method of monitoring					
	Rare/ endangered	Vulnerable to disturbance	Biogeo-graphical interest	Common indicator species	Search selected areas	Transect counts	Spring roadside counts	Christmas bird counts	Compile random observations	Review data of CGDs and NGOs
Common Loon		X	X		X				X	
Red-necked Grebe		X		X	X		X		X	X
Double-crested Cormorant	X	X	X		X				X	X
Great Blue Heron		X			X				X	X
Black-crowned Night Heron		X	X	X	X				X	X
Trumpeter Swan	X	X	X		X				X	
Mallard				X	X		X			X
Lesser Scaup				X	X		X			X
Red-tailed Hawk		X		X	X		X		X	
Ruffed Grouse				X			X	X		X
Bonaparte's Gull			X		X					
Great Horned Owl				X			X	X		
Northern Saw-whet Owl				X			X			
Yellow-bellied Sapsucker				X			X			
Great Crested Flycatcher			X		X				X	
Least Flycatcher				X		X	X			
Olive-sided Flycatcher			X		X	X				
Tree Swallow				X	X		X			
Barn Swallow				X	X					
Black-capped Chickadee				X		X	X	X		
Sedge Wren			X		X	X				
Veery				X		X	X			
European Starling				X		X	X			
Red-eyed Vireo				X		X	X			
Tennessee Warbler				X		X	X			
Yellow Warbler				X		X	X			
Chestnut-sided Warbler			X		X				X	
Palm Warbler			X		X				X	
Connecticut Warbler				X		X	X			

Table 5.3.1. (Continued).

	Reason for monitoring				Method of monitoring					
	Rare/ endangered	Vulnerable to disturbance	Biogeo-graphical interest	Common indicator species	Search selected areas	Transect counts	Spring roadside counts	Christmas bird counts	Compile random observations	Review data of CCDs and NGOs
Mourning Warbler				X		X	X			
Common Yellowthroat				X		X	X			
House Sparrow			X	X	X					
Northern Oriole				X		X	X			
Rose-breasted Grosbeak				X		X	X			
Savannah Sparrow				X		X	X			
LeConte's Sparrow				X		X	X			
Clay-colored Sparrow				X		X	X			
White-throated Sparrow				X		X	X			
Lincoln's Sparrow				X		X	X			

Options	Pros	Cons
1. Hire ornithological contractors every five years to completely re-sample avifauna inventory sample locations.	- can monitor status of all bird species rather than a few - ensures a high intensity of sampling effort and a high level of identification skills	- may not actively involve park wardens in resource monitoring - costly - difficult to schedule into long-term plan - may not detect changes in a timely manner
2. Assign seasonal wardens to monitor a sub-set of avifauna inventory sample locations, concentrating on key species only.	- involves park wardens in resource monitoring - sensitive to year-by-year changes - inexpensive - becomes part of the usual operating plan (ease of implementation)	- observer variability must be controlled - may not detect changes in status of non-key species
3. Rely on volunteer efforts by regional naturalist groups.	- inexpensive - active involvement of park users in resource monitoring	- observer variability high - sampling effort and consistency hard to ensure - time-consuming for coordinators - cannot be relied upon from year to year

We recommend that avifauna monitoring be an annual activity assigned to one or more seasonal wardens. Subject to modification which will be required once the second year's field work for the avifauna inventory has been completed and the data reviewed, the following schedule is recommended (Table 5.3.2).

Table 5.3.2. Monitoring schedule - sampling requirements.

	Week 1	Week 2	Week 3	Week 4
January				
February				
March	3 nights (owl surveys)			
April				
May	Search selected areas Re-locate and mark permanent transects			Field training
June	3 roadside surveys	Sample permanent transects (± 15 days)		
July	Sample permanent transects (± 5 days)		Survey ponds and wetlands	
August				
September				
October				
November				
December	One day (Christmas bird count)			

March: During the week on either side of the full moon, the roadside owl survey should be conducted three times as described in the methods section above. Analysis: Record the maximum number of each owl species at each stop (Table 5.3.3) over the three surveys, and compare the total for the whole survey route with totals from other years.

May: Weeks one to three: Search selected areas (Tables 5.3.4, 5.3.5) for nests of key species. Monitor breeding success if possible without undue harassment of the breeding birds:

Training period: Seasonal wardens are assigned five mornings during which to become familiar with the vocalizations and field identification of key species (see list above).

June: Week one: Sample roadside survey route three mornings, recording totals of each key species at each of the 50 stops. After three surveys record the maximum number of each key species at each stop and add the total together for each species; this total is to be compared with totals from other years (Table 5.3.3).

June: Weeks two to four: Sample transects.

July: Weeks one and two: 1, 2, 4, 5, 6, 7, 12, 13, 16 and 20. Sampling strategy should be as described in methods section, above. Compare overall totals for each key species on transects 1, 2, 4, and 5 (Poplar), on transects 6 and 7 (Muskeg), on transects 12 and 13 (Hay Meadow), on transect 16 (Mixed Forest) and on transect 20 (Sedge/Cattail Marsh), with totals from other years.

July: Weeks three and four: Survey the ponds and wetlands described above (Section 2.2.7) and record total numbers of all waterfowl species and of broods of ducklings.

Table 5.3.3. Sample roadside survey tally.

	Species A				Species B			
Stop #	Day 1	Day 2	Day 3	Maximum	Day 1	Day 2	Day 3	Maximum
1	3	1	0	3	0	0	1	1
2	0	2	1	2	1	1	1	1
3	1	1	1	1	1	2	0	2
4	0	1	0	1	0	1	2	2
5	0	0	1	1	0	1	2	2
6	1	0	1	1	2	1	2	2
7	2	2	3	3	2	2	2	2
8	0	2	1	2	1	3	3	3
9	0	1	1	1	0	2	1	2
Totals				15				17

Table 5.3.4. Selected areas for monitoring key species in May.

Species	Area
Common Loon	Canoe entire shoreline of Astotin Lake
Red-necked Grebe	Canoe entire shoreline of Astotin Lake
Double-crested Cormorant	Count roosting individuals and check Astotin Lake islands for breeding activity
Great Blue Heron	Blackfoot Lake colony Islands on Astotin Lake
Black-crowned Night Heron	Islands on Astotin Lake
Trumpeter Swan	Lakes and wetlands in the Cooking Lake morraine
Mallard	Intensively search selected islands on Astotin Lake
Lesser Scaup	Intensively search selected islands on Astotin Lake
Red-tailed Hawk	Bison paddock and Abattoir area, count hunting pairs
House Sparrow	Administration area; horse barns

Table 5.3.5. Selected areas for monitoring key species in June.

Species	Area
Great Crested Flycatcher	NE corner of park; Amisk Wuche trail; Long Island
Olive-sided Flycatcher	Muskegs along boundary road west of Oster Lake; muskeg at start of Hayburger trail
Tree Swallow	Wetlands along the north boundary road
Barn Swallow	Administration Area; Horse barns; Abattoir buildings; Oster and Isolation Warden Stations; Recreation Area
Sedge Wren	Northwest arm of Astotin Lake; transect #18; Goose Lake
Chestnut-sided Warbler	Between the first km of the White Spruce trail, and the parkway
Palm Warbler	Hayburger muskeg; other extensive open muskegs

A difference in the total for a species between one year and the next of more than 20% should be considered a positive indication of a change in abundance. A decrease of 20% from one year to the next, followed by a further 20% decrease in the following year should be considered indicative of a population in trouble, and priority should be given to determining the factors contributing to the decline and to implementing management solutions.

December: In cooperation with the Edmonton Bird Club, Fort Saskatchewan Naturalists' Society and other interested local groups, continue to conduct annual Christmas Bird Counts and to submit the count results to American Birds.

Objective 5 - Research

To encourage research as and when required for the guidance of, and the application to management actions, relating to avifauna.

1. Sound management of the avifauna resource would benefit from research to determine the impact of such management actions as spring burning, fall burning, high ungulate stocking levels and heavy recreational use on birds, and particularly on ground-nesting or easily-disturbed species. Such research would allow the park to assess more accurately the impacts of management decisions, in addition to being useful to land and wildlife managers elsewhere in the aspen parkland ecoregion.
2. Where monitoring indicates a sustained decline in the populations of key bird species, we recommend that research be undertaken to determine what factors are involved.

3. Because there are numerous problems inherent in accurately censusing bird populations, and because many environmental, biological and management factors influence bird populations, studies of less than three years duration are unlikely to provide meaningful results.

Objective 6 - Inter-agency Cooperation

To encourage, initiate and actively participate in inter-agency, cooperative efforts relating to avifaunal managment.

1. A pool of enthusiastic ornithologists, in the Edmonton Bird Club, Fort Saskatchewan Naturalists' Society and other groups, exists which could participate in Christmas Bird Counts, May Day counts and other bird counting activities that will contribute to the monitoring of bird populations.
2. Useful data are available to the park wardens from monitoring work by the Alberta Fish and Wildlife Division and Canadian Wildlife Service. The former agency monitors ruffed grouse populations and colonial birds in the vicinity of the park, while the latter agency coordinates intensive annual population surveys for waterfowl and other migratory birds.

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APPENDIX I. Critical reviews of EINP resource inventory documents.
by Kevin Van Tighem

Pollster, D.F. and L.E. Watson. 1979. Vegetation classification and evaluation - Elk Island National Park. Unpublished report prepared for Parks Canada by Techman Ltd. 137 pp.

A land classifiction and mapping scheme is judged by a number of criteria. It must partition the landscape into distinct, recognizable units characterized by real differences in vegetation, soils drainage and other ecological aspects. It must establish these differences by valid methods of field sampling and data analysis. It must present maps which are drawn accurately and consistently, and it must clearly explain the differences among the map units. Finally, the landscape categories and map units should have practical utility in addition to ecological integrity.

The vegetation classification and accompanying biophysical land classification prepared by Pollster and Watson, unfortunately, falls short of several of these goals. In reviewing the report, the enthusiasm and hard work of the authors is evident; the sheer volume of data collected and summarized in the two years of their project is quite impressive. It appears, though, that the project was of insufficient length to allow the authors to plan adequately and to interpret their results thoroughly. The result is an ambitious but much-flawed piece of work.

A. Project design

Although the Methods section is less than clear in this respect, it appears that the authors randomly sampled relevés throughout the park and analyzed their relevé data to create a computer-generated series of vegetation assemblages. They then mapped the vegetation of the park based on physiognomy and tried to interpret the mapping on the basis of their vegetation assemblages.

This approach is contrary to both established practice (e.g. Holland and Coen 1982) and logic. Although botanists may debate among themselves whether vegetation classification is prejudiced by the perceptions of the observer or is based on what is really significant ecologically, and may rely on random sampling strategies and computer data manipulation to reduce subjectivity, the practical reality of the matter is that vegetation does in fact differentiate into clear physiognomic categories that are recognizable both on the ground and in air photos. Preliminary vegetation mapping would have provided the authors with a basic stratification of the landscape. Random sampling of relevés within each of the mapping categories would then be appropriate.

The other aspect of project design in which there was a major flaw was in its timing. The abundance of open-sided polygons, unlabeled polygons,

inaccurate polygon boundaries and other errors in the final map, suggest that there was not enough time to do much more than a first-draft attempt at mapping. Similarly, the final report required major editing and corrections after it had been printed and bound (C. Blyth, pers. comm.). The quality of the relevé data analysis (see below) leads one to suspect that the authors had insufficient time to look at their data in the depth required. It appears that the time allotted this project was insufficient for the team to develop their expertise and thoroughly analyze their data.

There is evidence too, that the methodology may not have been clearly defined for the relevé sampling. On page 12 (line 5) the statement that "... stands contained only one relevé" contradicts the statement on page 19 (line 11) "... where it was known that two different soil units were present within ... a homogeneous stand ... two relevés were ... sampled".

B. Vegetation analysis

The authors present a list of floristic and environmental data that were collected at each relevé (page 12). In the subsequent discussion of data analysis it becomes quickly apparent that the bulk of these data were not used in developing the vegetation classification.

In fact, based on their description of the computer analysis on which they relied for their vegetation classification, the authors used plant species lists only. Even plant coverage values were ignored. Vegetation species groups are based on constancy and frequency, not abundance. Thus a single dandelion on the relevé carries the same weight as a field full of dandelions.

Since there was no preliminary stratification of vegetation by physiognomic class, and no subsequent weighting of species by coverage values in the computer analysis, very obvious differences in vegetation are obscured. The resulting categories are based on understory species and species which, though frequently only minor members of the plant communities sampled, are highly constant or frequent among plots.

There is, perhaps, an argument for this approach from a plant ecology standpoint. That is, the species with highest constancy in an assemblage are those which are most likely to be truly associated in terms of their ecological requirements. But by treating white spruce as just one plant on a species list whereas in fact it occupies more than half the stand and exerts its influence on the understory, on snow accumulation and snow melt patterns, on soil formation and on wildlife use, is not being objective; it's being obtuse.

The authors attempt to overcome this flaw by describing broad physiognomic categories (e.g. Picea glauca upland forest) on the basis of their associated species groups. This is another bit of inverted logic. The

species groups were identified on the basis of random sampling in all physiognomic types. To say that P. glauca upland forest includes species groups 5, 6, and 7 while the Corylus-Rosa upland forest type includes two of the same groups (5 and 7) plus a third (10), and may or may not be dominated by Populus tremuloides, is bewildering and strange. Attempts by park wardens and wildlife inventory staff to apply, or even interpret, this classification are inevitably frustrated. In the minds of the authors there may be a very clear and elegant logic to this vegetation analysis, but if that logic is inaccessible to the classification's users, then it is wasted.

C. Biophysical mapping

The approach of overlaying a vegetation map on a soils map and ground-truthing both independently was rejected by the Parks Canada Resource Inventory Task Force in the early 1970s. Integrated ecological land classification has proven superior to overlays of single-resource inventories. All recent resource inventories in Western Region have been of the former sort for this reason. The basic problem with overlay approaches is that mapping inaccuracies are magnified and the final map is not based on real ecological boundaries that are visible on aerial photographs, but on cartographic compromises and extrapolations. This problem is well known to Elk Island wardens and wildlife inventory staff; trying to find a place on the ground that corresponds with one of Pollster and Watson's map lines can be a very frustrating experience.

That the finished biophysical map was evidently a first-draft effort has been alluded to above. Further evidence of haste in its preparation can be seen by polygon size, which increases from north to south. Massive units mapped as P/S or P/G in the South or Isolation zones of the park appear both on air photos and on the ground no different from units that were much more finely subdivided in the North zone.

Polygon labelling is inconsistent. On page 20 it is stated that "the first mentioned (plant) community should be considered ... the most common one within the complex". On this basis most of the G/P map units are incorrectly mapped. Extensive mixed stands of white spruce and poplar north and east of Astotin Lake are mapped P/S. Any attempt to predict vegetation, let alone wildlife use or other capabilities, is confused by numerous inaccuracies or inconsistencies in the park biophysical map produced from Pollster and Watson's base map.

D. Recommendations

It is recommended that the entire Elk Island National Park Biophysical Land Classification be revised. The report and maps as they stand are not adequate. Logical flaws in the analysis and presentation of vegetation data are compounded by inaccurate mapping. The integration of eco-

logical data into the biophysical mapping was done through map overlay, not by aerial photography interpretation based on biophysical concepts, followed by integrated field sampling. The existing report and maps are essentially unusable for most management and wildlife applications.

It is essential, if the land classification is to be revised, that new maps be developed from scratch rather than attempting to salvage the existing maps. In terms of practical utility for resource management and wildlife interpretations, we recommend that mapping be based on current vegetation, that it incorporate mapping of aquatic vegetation, lakes and wetlands, and that discussion of potential medium or long-term vegetation changes be incorporated into the written part of the final product.

When the mapping has been completed, ground-truthed and revised, it may be possible to re-analyze Pollster and Watson's raw data and thus reduce the amount of new data that must be collected. Such a re-analysis should adequately weight the importance of such things as plant species coverage, soil type, drainage and surface expression of the landscape.

Reinterpretations of both Burns and Cool (1984) and the current avifauna inventory will be necessary, but these are feasible, given the manner in which their data were collected.

A final recommendation is that revision of Biophysical Land Classification take place in a time frame adequate for proper completion of the job. Although some of the problems with Pollster and Watson's work may have been due to inexperience, it appears that the sheer size of the undertaking led to them running out of time and having to present a partial analysis and inadequately edited and revised final report. Depending on staffing and intensity of effort, three years duration would probably be a reasonable minimum. Active involvement by park wardens would serve to ensure that the mapping and report are responsive to the practical needs of the users.

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Kemper, L. 1974. Water-oriented Birds of Elk Island National Park. Unpublished report prepared for Parks Canada by Canadian Wildlife Service, Edmonton. 154 pp.

An inventory of birds with regard to their habitats has two basic problems that must be dealt with in order for the result to be of practical value. Firstly, habitats must be classified and mapped on the basis of recognizable and distinct features that reflect the ecological factors influencing bird distribution. Secondly, sampling methods must be developed and applied to accurately count birds and determine their densities in each of the habitat categories recognized.

This review focuses on Kemper's successes in dealing with these two problems and on her presentation of the resulting data. Where she was less than successful, alternatives are suggested for better achieving the desired results. It must be borne in mind, however, that Kemper was only allotted a single field season in which to carry out her inventory. Further, in classifying and measuring any aspect of the natural environment, any approach designed to solve one problem generally creates a new set of problems. Thus, no criticism is intended as to the quality of Kemper's approach or report, both of which were excellent within the limitations of time, manpower and detail imposed upon her.

A. Wetland classification

The wetland classification developed by Kemper includes seven major wetland categories (page 7), although she collected data that would have allowed for a more detailed classification if time had allowed. The categories she identified and sampled are internally consistent and logical, and her analysis based on them is sound. If it has any major weaknesses, it is in its generality. It can be anticipated, for example, that an intermediate-sized wetland with more emergent vegetation than open water (IC) will have a certain value to Canvasbacks if the emergent vegetation is dominated by cattails and a different value if it is dominated by sedges, but these distinctions do not enter into her classification.

A further caution which applies also to terrestrial habitat classifications, but particularly to aquatic habitats, is that no habitat category remains static for long. Increasing beaver populations (Burns and Cool 1984) and frequent removal of beaver dams to control flooding of facilities and land, result in considerable change in wetland habitats. Waterfowl doubtless react to these changes through breeding failure, shifting of staging areas and year-to-year shifts in breeding locations. Thus any attempt to designate a single wetland as a single habitat type may lead to poor management decisions if that wetland regresses or succeeds to a different habitat type having different waterfowl values.

Consequently, the wetland classification table in Appendix 1 is potentially misleading since both the areal extent and vegetation cover of many wetlands fluctuate dramatically from year to year and even within years.

With regard to the general nature of Kemper's classification and its resulting inability to fully account for habitat selection by waterfowl, it is recommended that a more dynamic classification be developed based on the concepts developed by Millar (1976). His analysis of wetlands is based on a greater number of factors than were considered by Kemper, including vegetation zonation, proportion of vegetation to open water, wetland size, maximum depth, and position in watershed. Most of his classification concepts, which were developed in central and southern Saskatchewan, are directly applicable to the wetlands of EINP.

With or without a revision of Kemper's wetland classification system, there are a number of approaches by which the changes in habitat characteristics of wetlands might be dealt with:

1. Water levels could be stabilized within their natural fluctuation regimes related to seasonal groundwater levels, perhaps by controlling beaver populations at set levels. This approach is probably neither practical nor desirable.

2. Each wetland could be classified as to its actual location in the habitat classification scheme each time a wildlife observtion or management decision is made. To facilitate this a simple key, similar to the dichotomous keys used in plant floras, could be developed for the field worker to determine into which category he or she should put a wetland.

   This would require reinterpretation and extrapolations of Kemper's, our and possibly Millar's work, but it is quite feasible. A disadvantage is that the present habitat values may be different from other potential habitat values that stand to be lost if inappropriate management options are chosen.

3. Each wetland could be characterized with regard to its full range of potential habitat categories, based on its location in the drainage system, its potential for being flooded by beavers, etc. During any given survey of the wetland, its present habitat value would be noted but decisions on its management would be based on its potential as well as its present value.

   This holistic approach is most likely to provide resource managers with the level of knowledge they need to make sound management decisions. It would require extensive reevaluation of Kemper's, Millar's and our work, as well as further specific research as recommended by Kemper.

B. **Survey methods**

The literature on survey methods for inventorying waterfowl and other birds is extensive and varied (Miller and Gunn 1980, Ralph and Scott 1980, Sen 1982). Given the sheer volume of information on how to count birds it is perhaps particularly notable that each new worker in the field manages to devise their own variations. This applies to the present study as much as to Kemper's work. In fact, there is no single method that can be relied upon to give equally accurate counts in all situations and most methods are valid only in a narrow range of circumstances.

Birds are highly mobile. There are numerous species, each of which is more or less detectable and approachable, has different foraging, nesting and resting habits, and occurs in various numbers in various habitats and at various seasons. Most inventories of birds and their habitats are limited by the duration of the study, the number of observers, the size of the study area, the diversity of habitats, and uncontrolled environmental variables such as weather and population fluctuations. Consequently, a sampling strategy is a compromise between striving for statistically valid counts of all species in all habitats and doing what it is physically possible to do.

Kemper's techniques appear to have been a fair compromise among these factors, arrived at after field-testing of methods that proved impracticable. Due to the limited duration of her study, however, she was unable to sample equal areas representing each of her categories and to gather multiple-year samples to test her conclusions.

Major failings of the data analysis are that it lumps ecologically-dissimilar species under broad categories such as dabblers or grebes and that data are presented in terms of frequency of sightings (e.g. Table 1) or percentage of composition of bird fauna (e.g. Table 2), rather than in terms of density (number of each species per unit area of each habitat). The derived values she presents do not allow the resource manager to assess the relative importance of each of her habitat categories to each waterfowl species, thus limiting the utility of her report.

Re-analysis of her data and extrapolation from our data should enable resource managers to calculate densities of each species in each habitat category. These values can be used to develop a legend illustrating the approximate importance of each habitat category to water-associated birds, based on densities of each species during various seasons.

Such a re-analysis should be fairly straightforward assuming the raw data are still available. If the wetland habitat classification is significantly revised, however, there will be a need for a much more complex re-analysis as well as some additional sampling. It is recommended that all observations of water-oriented birds be recorded with reference to the present habitat characteristics of a water body, rather than to its

past or potential characteristics. This may require a modification to card 5 of the Warden Wildlife Card to allow use of Millar's wetland description code numbers.

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APPENDIX 2. Permanent terrestrial breeding bird sample transects.

There are 20 permanently-marked belt transects throughout EINP. Most are 500 m in length and 100 m in width, but some are longer. Length is indicated below only for those that are not 500 m.

The list below gives the transects in numerical order from 1 to 20, a location description and details on markings, habitat and work that may still be required on them.

Following the list is a set of blank field data sheets that were used for recording raw data. The data sheets have compass bearings, tag numbers and other relevant data for relocating them.

Transect #1

Location: Oster Road, 0.3 km west from the gate at Tawayik Picnic Area. Station 0 is 46 m from the middle of the road, on a 134° compass bearing. The transect centre line runs on a bearing of approximately 225°.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with metal tags at breast height, numbered in sequence from 569 (Station 0) to 579 (Station 10).

Habitat: Mapped as G/P. Primarily aspen forest with natural and artificial openings dominated by grasses accounting for approximately 10-15% of the transect area. Burned in 1983 spring.

Work required: Remove temporary markers (flagging) from centre line and lateral boundaries.

Transect #2

Location: Oster Road, 1.4 km west from the gate at Tawayik Picnic Area. Station 0 is 60 m from the middle of the road, on a 350° compass bearing. The transect centre line runs due north.

Markings: All stations are marked with metal tags at breast height, numbered in sequence from 587 (Station 0) to 597 (Station 10).

Habitat: Mapped as G/P. Primarily aspen forest with natural openings dominated by grasses and shrubs accounting for less than 10% of the transect area. Not recently burned.

Work required: Metal bar at Station 0. Remove temporary markers (flagging).

Transect #3

Location: Parkway, 1.3 km south of intersection with Oster Road (0.9 km north of Abbatoir Road). Station 0 is 52 m from the middle of the road on a 62° compass bearing. The transect centre line runs on a bearing of approximately 60°.

Markings: A 4 x 4 cm survey stake, painted orange, is visible from the highway, halfway to Station 0. Station 0 has a metal bar driven into the ground at the base of an aspen. All stations are marked with metal tags at breast height, numbered from 580 (Station 0) to 586 (Station 6) in sequence, and 598 (Station 7) to 600 (Station 9). Station 10 is tagged with tag number 535.

Habitat: Mapped as G/P. Primarily aspen forest with natural and artificial openings dominated by grasses accounting for approximately 10-25% of the transect area. Not recently burned.

Work required: Remove temporary flagging.

Transect #4

Location: Isolation Warden Station Road, 0.9 km north of gate at the Warden Station. Station 0 is 50 m from the middle of the road on a 220° compass bearing and the transect centre line runs along the same compass bearing.

Markings: Station 0 has a metal bar driven into the ground on the north-west side of a balsam poplar. All stations are marked with metal tags at breast height, numbered in sequence from 501 (Station 0) to 511 (Station 10).

Habitat: Mapped as P/S. Primarily aspen forest with natural openings dominated by grasses accounting for approximately 5-10% and wet hollows dominated by willows and sedges accounting for approximately 5-10% of the area. Burned in 1983 spring.

Work required: Remove temporary markers.

Transect #5

Location: Isolation Area Warden Station Road, 0.9 km north of the gate at the Warden Station. Station 0 is 45 m from the centre of the road on a 19° compass bearing. The transect centre line runs on a bearing of approximately 20°.

Markings: Station 0 has a metal bar driven into the ground on the west side and at the base of an aspen which stands on the south side of a narrow clearing. All stations are marked with metal tags at breast height, numbered consecutively from 512 (Station 0) to 522 (Station 10).

Habitat: Same as Transect #4 but this transect has not been recently burned and the understory consequently has less grass and rose and more shrubs.

Work required: Remove temporary markers.

Transect #6

Location: Parallel to and south of the road which runs due west from the park gate at the Oster Warden Station. Station 0 is 75 m from the warden station flagpole on a 245° compass bearing and the transect follows the same compass bearing. The transect is 600 m long.

Markings: All stations are marked with numbered metal tags. The tags were nailed to trees at breast height and follow sequentially from Station 0 (tag 901) to Station 12 (tag 913) A metal stake marks Station 0.

Habitat: Mapped as M with part of the transect in P/S. Primarly willow-alder/marsh marigold vegetation (10-25%) and black spruce fen (60-75%) with small inclusions of poplar and white spruce.

Work required: Remove temporary markers.

Transect #7

Location: Station 10 is found by travelling 132 m east from the corner of the park boundary at UTM UQ807435 and 211 m north from the boundary fence. The transect centre line runs on a bearing of approximately 280°.

Markings: All stations are marked with metal tags at breast height, numbered in sequence from 601 (Station 0) to 611 (Station 10).

Habitat: Mapped as M with a small component of G/P. Primarily black spruce fen with some stands of mixed white spruce and poplar (approximately 5%), open poplar forest (5-10%), and grassy or sedgy openings (5%).

Work required: Mark Station 0 with a metal peg. Remove temporary markers.

Transect 8

Location: Station 0 is 50 m due west of the east boundary fence, 85 m (19 fence posts) north of the corner at UTM UQ823436. The transect centre line runs on a bearing of approximately 290°.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with metal tags at breast height, numbered in reverse sequence from 622 (Station 0) to 612 (Station 10).

Habitat: Mapped as G/P. Primarily aspen forest with large grassy openings accounting for 15-25% of the transect area and stands of white and black spruce accounting for 10% of the transect area at the west end.

Work required: Remove temporary markers.

Transect #9

Location: Station 0 is due south of a telephone pole with a red plastic-coated lateral support just east of the Information Centre at the park's south entrance. The transect begins about 10 m south of the edge of a willow-alder/marsh marigold wetland and runs on a 190° compass bearing.

Markings: Station 0 is marked with a metal peg driven into the ground. All stations are marked with metal tags at breast height numbered consecutively from 623 (Station 0) to 633 (Station 10).

Habitat: Mapped as G/P. Dense aspen and balsam poplar forest with less than 5% openings of shrubby grassland. Wet shrublands account for another 5% of the transect area.

Work required: Remove temporary markers.

Transect #10

Location: Station 0 is 47 m due south of the 33rd fencepost west of the northeast corner of the park. The transect runs due south and is 550 m long.

Markings: Station 0 has a metal peg driven in the ground. All stations are marked with metal tags at breast height, numbered consecutively from 557 (Station)) to 567 (Station 10).

Habitat: Mapped as P. Aspen forest with an understory of hedged beaked hazelnut about 1 m high. There are several grassy openings outside the transect strip but only 5% of the transect strip is open meadow.

Work required: Remove temporary markers.

Transect #11

Location: Station 0 is at UTM UQ806412 (Soapholes area) on the south side of an abandoned vehicle track where it emerges onto a large grassy meadow from the east. Access is indicated by orange spray paint on the boundary fence east of Station 0. The transect runs generally west in a shallow arc through the centre of the meadow, extending 50 m into forest at the west end.

Markings: Each station is marked with a 4 x 4 cm wooden survey stake with metal tags nailed to the tops of the stakes, numbered consecutively

from 701 (Station 0) to 711 (Station 10). Each station is also marked with an orange wire flag marker.

Habitat: Mapped as G with some G/P. Primarily disturbed (overgrazed) grassland dominated by Kentucky bluegrass (Poa pratensis), with aspen forest accounting for approximately 20% of the transect area.

Work required: Permanently mark Station 0 with a metal bar and measure compass bearings to each station. Remove temporary markers.

Transect #12

Location: Station 0 is 112 m due east of Ross Creek and 7 m north of the service road that runs east from the barn and corral at the park's south entrance. The transect centre line runs on a bearing of approximately 93° parallel to the road.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with 4 x 4 cm wooden survey stakes with metal tags nailed to the top, numbered consecutively from 657 (Station 0) to 667 (Station 10).

Habitat: Mapped as A. Planted hay pasture dominated by domestic forage grasses and not grazed during the breeding season. There are several low-lying Carex spp. communities (about 5% of the transect area) and some small clumps of low Salix spp. growth (less than 5%).

Work required: Remove temporary markers.

Transect #13

Location: Station 0 is Station 10 of Transect #12. The centre line is at a compass bearing of 95° until Station 6, after which it is approximately 52°.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with 4 x 4 cm wooden stakes with metal tags nailed to the tops, numbered consecutively from 667 (Station 0) to 677 (Station 10).

Habitat: Similar to Transect #12, but Carex spp. accounts for slightly more than 5%, willow clumps cover about 5% of the transect area, and there is small inclusion of cattail vegetation.

Work required: Remove temporary markers.

Transect #14

Location: Station 0 is 38 m from the southwest corner of the dugout at UTM UQ78837, at a compass bearing of 217°. The transect centre line is on a compass bearing of about 220°.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with metal tags at breast height, numbered consecutively from 635 (Station 0) to 645 (Station 10).

Habitat: Mapped as S/P with some S. Primarily semi-open forest of balsam poplar and aspen with 20% of the transect area covered with open tall willow/grass-sedge vegetation and a further 20% covered with dense tall willow and alder thicket. There is an inclusion (less than 5%) of grass/low shrub meadow.

Work required: Remove temporary markers.

Transect #15

Location: Park west boundary road 2.2 km north of Highway 16, at a boundary marker sign on the park fence. Station 0 is 56 m from the boundary fence at 105°. It is further indicated by orange spray paint on the nearest fence post and by an orange wire flag marker at the edge of the forest.

Markings: Station 0 has a metal bar driven into the ground on the west side of the base of a tree. All stations are marked by metal tags at breast height, numbered consecutively from 546 (Station 0) to 556 (Station 10).

Habitat: Mapped as P/G. Aspen forest with a shrubby understory dominated by beaked hazelnut on ridged terrain. About 15% of the transect area is open tall willow/grass sedge vegetation.

Work required: Remove temporary markers.

Transect #16

Location: Long Island in Astotin Lake. Station 0 is in a hollow 45 m from the east end of the island. The transect is 800 m in length and curves along the approximate centre of the island.

Markings: The centre line is marked with survey flagging. All stations are marked with metal tags at breast height, numbered in sequence from 914 (Station 0) to 930 (Station 16).

Habitat: Mapped as F/P. The island is a complex of mixed white spruce/poplar forest, stands of pure white spruce, stands of white birch and poplar, and small openings with dense low shrubbery and grass.

Work required: Place metal peg at Station 0. Remove temporary markers.

Transect #17

Location: Adjacent to the abandoned parkway along the south shore of Astotin Lake. Station 0 is 90 m from the centre of the road at a 23° compass bearing from a point 825 m west from the gate at the golf club parking lot or 125 m west from the cultvert at UTM UQ787482.

Markings: Station 0 has a metal bar driven into the ground. All stations are marked with metal tags at breast height, numbered in sequence from 523 (Station 0) to 533 (Station 10).

Habitat: Mapped as P/S with inclusion of S/C. Primarily aspen forest with a shrubby understory of hazelnut and other species, less heavily browsed than on other transects. Small stands of white spruce cover about 5-10% of the transect area and there is a small (less than 5%) inclusion of tall willow/sedge-grass vegetation.

Work required: Remove temporary markers.

Transect #18

Location: Marsh south of Highway 16, 800 m west of the gate to the Isolation Warden Station road. Station 0 is 32 m due south of the boundary fence on the west side of a wooded peninsula that extends into the marsh from the north. The transect centre line runs on a compass bearing of approximately 196°.

Markings: Station 0 has a metal bar driven into the ground and all stations are marked with 4 x 4 x 90 cm wooden survey stakes spray-painted flourescent orange at the tops. Numbered metal tags were nailed to the stakes. Tags 646 to 649 were placed at Stations 0 to 3 and tags 651 to 656 were placed at Stations 4 to 9. Station 10 was not marked with a metal tag.

Habitat: Mapped as C/S and L. Periodically flooded (by beaver activity) lake margin that had not been flooded for at least two seasons in 1984. Dominated by grasses (*Calamagrostis canadensis*, *Glyceria grandis*, etc.), sedges and scattered willow clumps. Open water covers 5% of the transect and there is an open stand of mature aspen near Station 0 (less than 5%).

Work required: Remove temporary markers.

Transect #19

Location: Northwest arm of Astotin Lake. From UTM UQ768507, the transect centre line is travelled by canoe at a distance of 5 m from the edge of the emergent vegetation, along the lakeshore to UTM UQ767510.

Markings: There are no permanent markings. The beginning and end of the transect are marked with survey flagging and the sketch map/field data sheet is the only means by which the transect can be located.

Habitat: Mapped as C and C/S. Open water with Potamogeton and other submergents account for 50-70% of the transect area. The shoreline alternates between cattail beds and sedge/willow vegetation.

Work required: Redo the sketch map to exact scale. Permanently mark the beginning and end of the transect route.

Transect #20

Location: Goose Lake Road. Station 0 is 0.3 km from the northeast corner of the Isolation Area where the road emerges from the poplar forest onto the lake margin. There is a gap between Stations 2a and 2b, with 2b being 0.9 km from the northeast corner of the Isolation Area, at a culvert. The centre line follows the centre of the road.

Markings: The stations are marked with numbered metal tags nailed at breast height to fence posts on the west side of the road. Station 10 is numbered 534, Station 9 is 634, and Stations 8 to 0 are numbered consecutively from 536 to 545.

Habitat: Mapped as C/T. About 30-40% of the transect is shallow open water with the remainder being primarily Carex spp. with clumps of willow and cattail.

Work required: Remove temporary markers.

APPENDIX 3. Computer data storage and analysis.
by Kevin Van Tighem

1. Data storage

All observations recorded during the avifauna inventory, with the exception of the spring migration survey data for 1984, were coded on the standard "Wildlife Survey Data Forms" (WSDFs) used by the Warden Service to submit wildlife data to the Canadian Soil Information System (CANSIS) data storage facility in Ottawa. Our data were keypunched and stored in the University of Alberta computer, and when all the data analysis detailed here was completed, the data and analysis files were copied to tape and the tape, which accompanies this interim report, was forwarded to CANSIS.

Because of the particular needs of the avifauna inventory, modifications to the normal coding system were developed. These are described here in detail. An understanding of these modifications is essential for park resource managers to use the computer tape accompanying this report.

Each observation is coded on one, two or three lines of a WSDF (cards 1, 2 or 5), with each line containing a different subset of information related to that observation. For data analysis we used only card 1, and this description explains how card 1 data were recorded on that line.

Survey Type (columns 77 to 80) is coded as follows:

CP84	Count plot data
BT84	Bird transect data
FMS1	Fall migration survey (terrestrial and water birds) data
FMS2	Fall waterfowl migration survey data
PPB5	Casual or non-structured observations

The data analysis programs described below and stored on the accompanying tape rely on these codes to determine which set of data to analyse for various purposes.

CP84 (Count plot) data were recorded with singing or otherwise obviously territorial males in columns 58 and 59, and with the total of all birds seen, territorial or otherwise, in columns 50, 51 and 52.

Columns 49 to 56 were coded differently from the way they are intended to be coded for CANSIS. Columns 49 and 50 contain a two-digit number representing the percentage (to the nearest 5%) of the area of a circle with 50 m radius, centered on the observer, which included the habitat being sampled. If the observer was in the center of a patch of homogeneous vegetation, 99 was recorded. This value is used to calculate the effectively-sampled area of each habitat in the data analysis program.

Column 51 contains a weather code number and column 52 contains the Beaufort scale number for wind intensity. These values were not used in any data analysis. Columns 53 to 56 record the time that the sample started, to the nearest minute.

There was a further modification made to the Card 1 data for CP84 observations. Since the habitat codes on Card 1 are standard CANSIS codes and do not relate to the park biophysical, the data file was manually edited to replace the habitat codes with codes that indicate the biophysical vegetation type of the mapped polygon where the sample was collected. Thus, the codes in columns 31 and 32 of the data file EI.DATA are not compatible with CANSIS, at least in the case of CP84 observations.

BT84 (Bird Transect) data were coded in a similar manner to CP84 data, with singing or otherwise territorial males in columns 58 and 59, and with the total of all birds seen, territorial or otherwise, in columns 50, 51 and 52. Columns 49 to 56 were also coded in the same manner as for CP84 data, except that columns 49 and 50 contain the transect number (from 1 to 20).

FMS1 and FMS2 (fall migration survey) data were recorded only on card 1, because of the sheer mass of data collected; there are no card five lines of data for these surveys.

All the bird observations are recorded in three files on the accompanying tape:

EI.DATA - contains all the observations that were recorded during the 1984 field season. The CP84 and BT84 data are recorded as described above.

FMS2 - contains all the FMS2 data; these data are also in the above file, but because of a programming glitch they must be retained on this file as well.

AVIFAUNA - is a duplicate of EI.DATA, except that the data are recorded in a format that is compatible with CANSIS. That is, there are the correct habitat codes in columns 31 and 32, and columns 49 to 56 contain blanks.

2. Data analysis

Data analysis programs were developed by Dr. Terry Taerum of the University of Alberta, using the SPSSX statistical package. The analysis programs are on the tape which accompanies this interim report. To use the program and to have access to our data from the avifauna inventory, follow the instructions below:

1. Deliver the tape to the University of Alberta Computing Sciences Input/Output room on the second floor of the General Services Building. Register it with the attendent there; you will be asked if it has a volume number and you should have the small cardboard receipt with you, since this receipt has the volume number on it. You will be given another receipt with a rack number (070196) and volume number (BIRDS).

2. Sign on to the MTS system under the signon ID to which you have registered the tape.

3. Enter the following commands:

```
#MØUNT 070196 9TP *T* VØLUME=BIRDS RING=ØUT
#RUN *FS 0=*T*
=REVIVE
=STØP
=YES
#FILESTATUS
```

4. The computer will now give you a list of the files you have restored from tape, and you can now proceed to use them. Instructions for using them are given below. The files have been copied from the tapes, so you may detroy them when you are finished with them, since you will have the originals still on the tape. However, if you change the programs in any way and want to preserve the new version with your changes in it, you should save this on the tape as follows:

```
#MØUNT 070196 9TP *T* VØLUME=BIRDS RING=ØUT
#RUN *FS 0=*T*
=SAVE newfile
=STØP
=YES
```

The files that have been saved on the accompanying tape are described below:

EI.DATA see above
FMS2 see above
AVIFAUNA see above

BIRDS.SPSS: This file is essential for almost all the data analyses below, since it converts the data in EI.DATA into a format that can be analysed by SPSSX. It puts the re-arranged data into a new file (which it creates on its own) called BIRDS.SAV. So the first thing you should do once you have revived all the files as shown above is to run this program. All you have to do is enter the following command:

```
#SØURCE BIRDS.SPSS
```

Q1: This program analyzes all the data from the breeding bird transects. It pulls out all the lines of data coded with sample type BT84 from BIRDS.SAV and calculates the density (birds/hectare) of each species on each transect. It takes the highest single count of a species on any one survey of the transect and treats this as the number of birds of that species present. The actual area of each transect is in BIRDS.SPSS, so if you find that you have a better estimate of the area of, for example, transect #19 than the one with which we worked, you should edit BIRDS.SPSS and insert the correction in the appropriate place, then run it again and then run this program.

The output that you receive from this program sorts the data both by species then transect number, and by transect number then species. Densities are calculated for both territorial males only (ADMALE) and for all birds recorded (TOTAL).

This program does not calculate diversity indicates; these were calculated manually from the output of Q1, based on Brillouin's formula (Schemnitz 1980), using densities of territorial males adjusted to birds/10 ha.

To run this program you need first to have run BIRDS.SPSS, and then all you do is enter the following command:

```
#SØURCE Q1
```

Q1.CLUS: This program is similar to Q1, in part. It calculates the density of each species on each transect, but it then adds 1 to each density, calculates the logarithm of the new number, and uses these derived values to compare the transects and determine which transects are similar to which others. It uses a cluster analysis procedure based on the squared Euclidean measure, which is part of the SPSSX statistical package.

The reason for converting the densities to different numbers is because the computer only looks at numbers and as far as it is concerned a density of 0.0 robins on one transect is more similar to a density of 0.2 on another than is a density of 0.8. The conversation gives more weight to presence/absence of a species than would otherwise be the case.

This program only compares the densities of territorial males; it does not look at totals. The cluster analysis indicates the relative degrees of similarity from one transect to another, based on the species present and their densities on each transect.

To run this program you need first to have run BIRDS.SPSS, and then all you do is enter the following command:

```
#SØURCE Q1.CLUS
```

Q2: This program was designed to test the possibility of sampling at certain time periods to get the best results for various species. The purpose was to see, for each species, which periods of time were most likely to produce the highest count in a given area. It was hoped that this would allow us to identify certain key species and the appropriate time of morning to count them, for a monitoring program to follow from this inventory.

Based on the exact time when a sample of a transect began, the samples for all transects are grouped into five time categories:

4 0400 to 0459
5 0500 to 0559
6 0600 to 0659
7 0700 to 0759
8 0800 to 0859

The program displays a table showing, for each species, the number of transects on which the highest count was recorded in any particular time period. This allows you to determine which time period is most likely to produce the most complete count of any given species, once the results have been corrected for sampling frequency (which this program does not do). Data are presented for both territorial males and for total count.

To run this program you need first to have run BIRDS.SPSS, and then all you have to do is enter the command:

#SØURCE Q2

Q3: This program presents the raw transect data (BT84) in a tabular form for ease of reference and was used to assess monitoring alternatives. It has little direct application to inventory analyses. To run this program you need first to have run BIRDS. SPSS, and then all you do is enter the following command:

#SØURCE Q3

Q4: This program selects all the count plot (CP84) data from BIRDS.SAV and analyzes it to calculate density (number/hectare) of each species on each habitat type that was sampled with count plots. The densities are calculated for both territorial males (ADMAL) and all individuals (TØTAL).

Total area of each habitat that was sampled is listed in the output from this program in square meters for each habitat. This figure is calculated by adjusting the area of each 50 m radius circle (7854 m^2) by the percent of the circle that was sampled on each count plot in that habitat (columns 49 and 50).

The output is sorted by species then habitat, and by habitat then species.

To run this program you need first to have run BIRDS.SPSS, and then you enter the following command:

```
#SØURCE Q4
```

Q4.CLUS: This program calculates the same densities as does Q4, but it then clusters the habitats in a similar manner to how this is done in Q1.CLUS. Only the densities for territorial males of each species are assembled and analysed in this program. The output shows the degrees of similarity among various habitats in regard to species composition and relative abundance.

To run this program, having already run BIRDS.SPSS, enter the following command:

```
#SØURCE Q4.CLUS
```

Q5: This program assembled all the data from fall migration surveys (FMS1) in BIRDS.SAV and lists it by species and date. It shows the number of each species that was recorded on the survey route on each date on which the survey was sampled.

To run this program, having already run BIRDS.SPSS, enter the following command:

```
#SØURCE Q5
```

Q.6: This program produces a table that shows the maximum single day's count (MAX), the earliest record (YEAR1, MØNTH1, DAY1, TØTAL1), and the latest record (YEAR2, MØNTH2, DAY2, TØTAL2) for each species recorded on fall migration surveys (FMS1).

To run this program, having already run BIRDS.SPSS, enter the following command:

```
#SØURCE Q6
```

Q7: This program is the same as Q6, but it produces a table based on all the data in BIRDS.SAV, not just the fall migration survey data. To run it, having already run BIRDS.SPSS, enter the following command:

```
#SØURCE Q6
```

Q8: This program sorts out the data in BIRDS.SAV and produces a table with headings written on each page. The table presents all the data on all the card 1 lines in the file in addition to information such as transect number, percent, weather, wind and exact time, where these

are relevant. The data are sorted alphabetically first by species code, then by habitat type, and then by sample type.

To run this program, first having run BIRDS.SPSS, enter the following command:

```
#SØURCE Q8
```

Q9:This program assembled all the data in FMS2 and calculates the density of each species of bird on each wetland type (as defined by Kemper (1977) over the whole period of the fall waterfowl survey (FMS2). The density is expressed as number/100 hectares for ease of reading, since there would otherwise be a lot of decimal numbers. Density is calculated by adding up the total of all observations of a species on surveyed wetlands of each type, over the whole sample period, multiplying this number by 1,000,000, and dividing this number by the area of the wetland type sampled on the survey route (in meters^2) times 19, the number of surveys that were run in 1984.

Q9 is set to run only with data from the survey route that was used in 1984. If a different survey route were chosen in the future and Q9 was to be used for analyzing the results, it would require revision. The name of the new data file would have to be substituted form FMS2 throughout Q9. The total areas sampled of each wetland type would also have to be changed in Q9. These conversions are fairly easy for a person who has edited files on the U of A MTS system.
To run this program, simply enter the following command:

```
#SØURCE Q9
```

If, in subsequent years of this avifauna inventory or of avifauna monitoring, there is a need to analyze a new data set separately from the 1984 data, the new data should be assembled in a file in the same format as EI.DATA. Change all references to EI.DATA in BIRDS.SPSS to the name of the new file, and then run BIRDS.SPSS. You may then proceed with the rest of the analysis as shown above. Thus, if there is new count plot and bird transect data, and this is stored in a file called NEWFILE, the following commands should be entered:

```
#MØUNT 070196 9TP *T* VØLUME=BIRDS RING=OUT
#RUN *FS O=*T*
=REVIVE
=STØP
=YES
#EDIT BIRDS.SPSS A@A /F 'EI.DATA'NEWFILE'
#SØURCE BIRDS.SPSS
```